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The Journal
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OUR FIRST RESERVE.

By Captain L. LOFTUS B. FOX, Royal Longford Rifles.*

AFTER having long been kept out in the cold, there seems at last some prospect of the Militia being admitted to the sunshine of national favour, for the question of Military Reserves has come to the front, and the most competent authorities are agreed, not only that an Army of Reserve is requisite, but that the Militia is the source from which it is to be obtained, and as a Militiaman I hope that I shall not be considered presumptuous if I offer a few remarks on the present organization of the Militia, and its adaptability for the purposes of an efficient Reserve.

It may be as well, in the first place, to inquire why it is we require a Reserve, and to define the terms "Reserve" and "Militia."

There is very high authority for stating that we require a Reserve, because on a sudden call, any of the great continental nations can muster their hundreds of thousands in the field, while "perhaps we "might assemble in the United Kingdom some 40,000, or at most "50,000, effective men of all arms of our regular forces" (*vide* Report of Commissioners on Military Recruiting); because "it has become "absolutely necessary to place ourselves less at the mercy of events "than we appear to be at the present moment" (the *Times*); because experience has warned us "that in future wars will be so sudden, so "sharp, and so short, that there will be no time for preparation" (General Peel's speech, Nov. 9th, 1866); and because "the history of "the recent war in Germany has taught us that whatever combatant "force is maintained, the complete equipment and machinery for a "much larger one must be prepared and kept at all times ready for "immediate use" (*Edinburgh Review*).

As I understand the word "Reserve," it means, an inexpensive auxiliary force, capable of rendering immediate assistance to the regular forces in cases of sudden emergency—in fact that, like a fire brigade, it can turn out at a moment's notice.

The Militia may be shortly described as a force called out each year for 27 days' military training, and commanded by officers appointed by the Lords Lieutenant of counties.

This force has been styled by the highest military authority "Our first Reserve," and concisely defined by the *Times* newspaper as "a "dormant element of national strength, available at an hour's notice, "and yet not trenching to any serious extent upon the resources of "the Treasury or the industry of the population." This is the official and traditional, and what may be termed the public-dinner-theory respecting our Militia ever since its first establishment in the days of Charles II., and if it were but true, would define a force whose value could not be too highly estimated, and whose reformation would be a work of supererogation. But, unfortunately, it is not so highly estimated by the nation, and, to tell the plain truth, is regarded by many of those who think about it at all as a mouldy and unmeaning relic of the past, and by not a few as an unmitigated nuisance. It is not saying too much to affirm that it absolutely counts for nothing with military men, and of those connected with it, from the Minister of War to the lowest drummer boy, there is not one who can really believe that it is an "element of national strength available at an hour's notice." There is not a man in the community who regards it with pride or security. The regular Army look upon it with undisguised contempt, the civilians who are not brought into contact with it regard it with derision, the civilians who are, with aversion, for in too many cases it symbolises to the inhabitants of those districts in which the annual musters are held all that is debauched, lawless, and degraded.

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* This paper was submitted to the Council in June last, but its publication has been unavoidably postponed till the present time.

Without at all admitting that the Militia merits such general scorn and sweeping censure, I fear that public opinion is in the main, correct as to its utility.

I will endeavour to show that such is the case, and that the
shortcomings of the Militia are not attributable to lack of zeal on the
part of its members, whose hands are tied behind their backs, ar
who are perfectly helpless in the matter, but to the persistent disrega
on the part of the nation, of those indispensable conditions, alrea
quoted from the *Times*, without which an efficient force is an impos
bility.

These conditions are, 1st, that the force be dormant; 2ndly, ch
and, 3rdly, available at a moment's notice. If it be not the first
second, it is nothing less than a standing Army. If it be not the t
the country in the hour of need will derive but little benefit fro
antecedent cheapness and immobility, and it follows that if a
these essential conditions be wanting there can be no efficien
serve, and it appears to me that it is because the third and
essential, because the vital condition, has been neglected fro
days of Charles II. to the present time, that our Militia has
through all those 200 years, a bye-word and a reproach amo
people, instead of being a source of national pride, and a
tower of national defence.

What are the principles on which the Militia was organized
still maintained, but those of Feudal ages and of patriarcha
long prior to the Feudal ages, when nations were enumerate
many hundred thousand fighting men, besides women and chi
when every able-bodied man was both soldier and civilian,
nomad shepherd of yesterday was the Captain of the Host of

No better system was obtainable or possible for those primitive times, and it was equally well adapted to the Feudal ages, when every inch of land was held by military tenure, when every man's hand was against his neighbour, and when it behoved him who cared to live, to know how to fight. Unquestionably the artisans and clod-hoppers of those rough times were as skilful, perhaps more so, in the use of the sword and spear as of the shuttle and the hoe. But when the Feudal system mouldered away, and was superseded by that of standing Armies—when the man of peaceful pursuits did his fighting by deputy instead of with his own right hand, there was then no longer any necessity that he should be skilled in the use of arms, and he speedily became slack in military matters, and ultimately lost all knowledge of them. It could not have been otherwise. A man cannot be a soldier any more than he can be anything else by intuition, and when soldiering was no longer compulsory or generally necessary, it was not to be expected that the agriculturist or artisan would voluntarily take to it as a profession. Thus the third and most vital essential of the old system, namely, that every citizen was available at a moment's notice, died out. But the fact was ignored at the time, as it is now, and the skeleton of the feudal system was preserved, under the name of *Militia*, though the vital spark was extinct. Cheapness and the dormant condition were easily maintained, and efficiency was expected to follow as a necessary consequence. But that it did not do so, even in a generation who could remember Naseby, and had taken a part in the Battle of Sedgemoor, is apparent from the literature of the period. Dryden's Militiaman is pretty much the same as Punch's in our own day—

> "Raw in fields the rude Militia swarms,
> Mouths without hands maintained at vast expense;
> In peace a charge, in war a weak defence,
> Stout for a month, they march a blustering band,
> And ever, but in time of need, at hand."

Very different were the terms in which Shakespeare spoke of the raw levies of the 15th century. They are, indeed, covered with ridicule, but not on the score of inefficiency. They are "slaves as ragged as "Lazarus in the painted cloth," "discarded, unjust serving-men, "women's tailors, revolted tapsters," &c., but they are not "mouths without hands," even the country bumpkin Wart, "the little lean old "chapped bald" Militiaman is a proficient in the Manual of the day and "manages me his caliver exceeding well," and Falstaff, though he would not march through Coventry with his raw recruits, did not hesitate to lead them, without a day's training, to the front of the battle, where if being "peppered" almost to a man, is any test of stout fighting, they fought as well as the best. Shakespeare's Militiaman was available at a moment's notice, and Dryden's was not, because the Feudal age necessitated every man in the community being expert in arms, and the standing-army-age did not necessitate individual efficiency, inasmuch as the battles of the country were to be then fought not by the nation at large, but by the professional soldier, especially trained and paid for that purpose.

To be available at a moment's notice is, and always has been, the main spring, the very life, of every military organization, active or dormant; but this vital principle is not intuitive. It must be infused into the system, and be carefully cherished there, or it will languish and die, and the system with it. An untaught country lout cannot fight on equal terms with a trained soldier, nor can he obtain those equal terms by being hustled about in a drill field for 27 days in a year. There is no royal road to a knowledge of soldiering any more than there is to anything else, and yet from the days of Charles II. to the present, England has been saying to her first Reserves, "I have made you "cheap, I have made you dormant, make yourselves efficient." and presupposing the possibility of doing this, has wrapped herself up in the delusion, that she possesses in the Militia an element of national strength available at a moment's notice.

On that point I take issue, and I venture to assert that our Militia, or any Militia so constituted, is not, or ever has been, or ever could be, *quâ* Militia, an element of national strength, or an efficient Reserve for an unforeseen emergency.

It may indeed be urged, that the Militia did yeoman service in the wars of the first Napoleon, by releasing the regular forces from home duty, and furnishing them from time to time with recruits fairly disciplined. Nor can it be denied that in these respects it was of some use, but a force that had been embodied for nearly a quarter of a century was virtually more a standing Army than a Militia, though to the last, from the inherent defects of its system, ever an unreliable force. And the question is not whether during that protracted period it became serviceable to a certain extent, but whether it was when first embodied, or for long after, an efficient reserve able to cope wi
an emergency at a moment's notice. In those days, that word eme
gency had a very different signification from what it bears in our time
War loomed long in the distance before bursting over a country, a
then dragged its slow length along for years without any decis
results. There was ample notice, and ample time and opportunit
working up raw materials, but as far as I know, no one ever drea
of bringing the Militia to the front, or placing it in any post of dan
except in the case of the French invasion of Ireland, when the re
were, to say the least, not encouraging; and I doubt if there are
Militia regiments who took part in that campaign, who would ca
emblazon on their colours the actions in which they were engage
do I know any portion of the United Kingdom in which the Mili
held in such contempt as in that part of it where for the first an
time it took the field against a foe. Even at their best, the nati
no faith in its constitutional defenders, they were still a bye-w
reproach, a reed on which the country refused to lean, and aft
peace of 1815, they were suffered to melt away without lame
total nothingness and oblivion.

Nor when exhumed, during the Crimean war, was their organiz
any way improved. At the time of their embodiment and f
after, they were notoriously a rabble and nothing more; and
two years of constant training and discipline, some few re

amongst them vied in some degree in efficiency with the line, it was owing to their voluntarily availing themselves of the opportunities afforded by such a protracted embodiment; the great majority, however, who to the last failed to approach to such, or in many instances to any measure of proficiency, are a strong proof how little the authorities regarded them in the light of a *first reserve*, or thought it worth their while to take any proper steps to make them so.

I freely acknowledge that much has been done since then to put the Militia on a better footing. Previous to the Crimean war it was a perfect myth. The Adjutants, who had nothing earthly to do but draw their pay, were all that remained (in memoriam) of the great constitutional force. Since then, annual trainings and inspections have been revived, efficient staffs constituted, recruiting admirably organized, clothing, arms, drill, discipline, interior economy, personal comfort of the men carefully attended to, a special department created with a distinguished General Officer at its head to supervise and control the force, and yet, if an emergency arose to-morrow, where is the Militia regiment in the United Kingdom available to grapple with it? Is there a General in the Service who would venture into action with the flower of our Militia as it now is, against the worst disciplined regular Army in existence, European or Oriental? Improvement has just stopped short of practical utility, every step has been in the right direction, but none have gone far enough. The organization has become more perfect every year, and yet has stopped short of efficiency, and all that has been done is fruitless, because no opportunities are afforded us of availing ourselves of this admirable organization.

It must be borne in mind that the Militiaman, except he be taught by authority, has neither inducement, nor means, nor capability, of teaching himself. When his training is over, he lays aside his rifle and his uniform, and is not permitted to use either one or the other until called up for training again. Nor is he the stuff out of which Volunteers are or could be made; a man who of his own accord hires himself out for one shilling and two pence per diem, cannot afford himself the luxury of amateur soldiering, and yet notwithstanding the patent fact that he is of himself perfectly helpless, and also the experience of 200 years, a great blot remains untouched, and the Militiaman is still expected to learn the whole duty of a soldier in twenty-seven days. Recruit and company drill, battalion and brigade exercises, some knowledge of musketry, experience of the interior economy of a regiment, *esprit de corps*, and habits of discipline are all essentials for the soldier, they cannot be dispensed with, and they cannot be acquired in twenty-seven days. Something may be done as to drill. As a Musketry Instructor, I can safely say that next to nothing can be done with musketry, and that under the most favourable circumstances it would take five years to put a ten company regiment once, and imperfectly, through the course. As to habits of discipline, without which a soldier on active service is worse than useless, how can they leaven the whole man as they ought in twenty-seven days, or at all when, as is too often the case, a Militia regiment is billeted during its training on the public-houses of a country town? I trust I may not be considered presumptuous if I say that I cannot see how the Government scheme of an Army of Reserve, as far as it has been developed, is calculated to meet matters. The Militia are to be recruited up to their full number, but how will that increase individual efficiency? 100 sheep are as helpless as 50 against the wolf. Thirty thousand men (about whom I have a word to say presently), are to be picked out from the rest, and, in some way not specified, to be made more efficient than their fellows, but bearing in mind the modern acceptation of the word "emergency," how does this secure the efficiency of the remaining 90,000 men who are debarred from similar advantages. The control and organization of the Militia have indeed been handed over to a distinguished General Officer, but much on the same terms as the making of bricks was entrusted by the Egyptian taskmasters to the Israelites of old. The task is that 130,000 rough clods are to be worked up into efficient fighting men in twenty-seven days; a task which we have been for 200 years endeavouring to accomplish, which we have hitherto totally failed to accomplish, and which no nation in the world in any age has ever accomplished; yet this is the task required of the New Reserve Department. We must clearly understand that this is the task and no other. In these days when wars burst like a thunderstorm without warning over our heads, and are matters of but a week or two, and in a country which could bare oppose 40,000 regular troops to an invading Army, a Reserve Fc must be something more than a nursery for the line, or the ge merely of future organization; it must be a good thing and not mer the promise of good things to come, a present and not a prospec help in time of trouble: in a word it must at all times be a Ser capable of independent, though subordinate action, able at a mon notice to defend garrison towns, as well as occupy them; to ba the Regular Army in the field, as well as feed them with recru a Reserve cannot do this it is but an imposture and a make- and would prove as worthless for defence in the hour of need, a the men in armour of a Lord Mayor's show.

This is but the simple truth, and yet the nation will not truth in the face, but persists in demanding bricks while it straw. In fact the Militia question has never been fairly de yet, it has never been discussed on its merits or probed to th it is the political red-hot poker which statesman after state grasped only to drop again.

Whenever the Militia question crops up in Parliament or it is jumped upon, stifled, and buried out of sight as speed sible. No one dares to grapple with it, to strip it of its theo traditional trappings, and expose it as the arrant cheat, the sham, the poor helpless, lifeless scarecrow that it really vidually we know this to be the case, and very freely ack to one another in our individual capacities, but as a natio the fact, because if acknowledged it would present itse ugly fact, which could only be got rid of by decisive which we are not inclined, in other words by *opening ou to the Militia.*

This is the great lion in the path.

No statesman has been able to bring forward a comprehensive scheme of Militia organization; he has been obliged to speak evasively and mistily, and with bated breath to veil the whole truth, to propose measures which are totally inadequate and admittedly makeshifts, because he knows that the nation has no faith in the Militia, and will not submit to costly experiments on its account. In this country everything is a matter of FAITH and MONEY. Where there is faith, there money will be poured forth like water; where there is no faith, the purse strings will not be relaxed, let the charmer charm never so wisely. We believe in blue books and naval experiments, and, though warned by experience that both might prove valueless, would sell the shirts off our backs to indulge in either one or the other. The Militia, though we affect to regard it as the great constitutional force of the country, we do not believe in, and refuse to dole out more than a beggar's alms for its maintenance. And the instructions to those who administer or would reform its system, appear to be virtually the same as those which Lord Hotham asserts were given to the Royal Commission on Recruiting—"Mind you don't recommend anything which "will entail an increase of expenditure." We cling to the shadow, but reject the substance, and the result of all the commissions, and schemes, and legislation, of late years, has been that though there has been much tinkering, LIFE has not been infused into the Militia, a corpse has been galvanized, the outside of a cup and platter cleansed, a sepulchre whitened, and that is all.

It is really time that there should be an end of all this. If we have no faith in our Militia let us say so openly, and throw it overboard at once, and, if possible, obtain our reserve from some other source. But if we are determined to mould the Militia into an efficient reserve, let us manfully look its deficiencies in the face and seriously address ourselves to remedy them if we can, and above all, let us give it fair play. Don't let us play fast and loose with it, or set it a task to do and then tie its hands behind it, but deal with it on its merits, and endeavour honestly to make it an element of national strength available at a moment's notice.

When we reflect that 136,000 men of the Line (to speak of the effective services only) cost upwards of £10,000,000 annually, and 134,000 men of the Militia cost not quite £1,100,000—that the men of the Line drill 365 days in the year and the men of the Militia 27—that the men of the Line acquire *esprit de corps* and habits of discipline by constant supervision and association in well-ordered barracks, while the men of the Militia, billeted through the slums and public-houses of country towns, run riot uncontrolled—that the men of the Line are officered by professionally trained soldiers appointed by a soldier, and the men of the Militia by untrained civilians appointed by civilians—and further reflect that this organization of the Line is essential to its efficiency, it will not be difficult to place our finger on some of the principal blots on the Militia system.

But if these points of comparison between the Line and the Militia show some of the sources of the latter's weakness, they appear to me to indicate also the sources from which it is to obtain increased vigour and vitality. I will take these points *seriatim*. The first two, inadequate estimates and inadequate training, are inseparable, and must be considered together. But here the tax-payer and the political economist stop the way. The tax-payer will not submit to a material increase in the military estimates, and the political economist will object to the prolonged withdrawal of 130,000 men from the labour market. I will endeavour to show that neither the estimates nor the labour market need be affected to any excessive degree. If the experience of all times proves conclusively, as I think it does, that a knowledge of soldiering cannot be intuitive, recent events have, on the other hand, clearly shown that a man can be rendered efficient for active service in far less time than was thought to be possible even a few years ago. As Lord Hartington remarked in his speech on General Peel's scheme for organizing a Reserve, "If the German war "proves anything, it is, I think, the fact, that in the Prussian campaign "in Bohemia, it was clearly shown that an efficient infantry soldier "might be obtained by an amount of drill not exceeding three "years—indeed, a great part of the Prussian Army was composed of "men who had only served one year."

Nor must it be forgotten that the Landwehr of the first call, wi
less service still, and who are essentially a Militia Reserve force, h
a conspicuous part in the campaign, and contributed largely to
success of the Prussian arms; and I think that most military
who have been connected with the Militia, or have been in the
of inspecting them at their annual trainings, will be of opinion, th
is amazing what an amount of drill and general knowledge of sc
ing can be picked up by a man even in 27 days—picked up
alas! only dropped again, for 27 days are not sufficient to give
time to absorb and retain the knowledge and habits he has
The real problem is, how to give the Militiaman a leav
soldiering that will make him serviceable on an emergenc
seriously trenching on the resources of the country. Thi
Prussia has solved, and the other nations of the continent a
for themselves, and while to graft the feudal and coercive
of the continent on the voluntary system of Great Britain
impossible, I think we might take some useful hints from
adopt with advantage some such plan as that on whic
French Garde Mobile is based. I would therefore su
instead of a uniform training of 27 days every year, o
the Militia force should be embodied annually for t
another third for two months, and the remaining thi
month. In other words, to have in 1869, say 50 regime
three months, 50 for two months, and 50 for one mon
regiments that were out for three months in 1869 to
two in 1870, and for one in 1871, and so on with every
succession. By this system every Militiaman would rece
a three months' brushing up, and learn lessons which h
he would, forget, and acquire habits which he co
would, shake off, and which would be kept alive by th

of training in the two intermediate years. But, above all, there would then be time to impart to the Militiaman some knowledge which he does not now possess, of brigade movements, for battles are not fought by isolated regiments, but by associated regiments habituated to brigade movements; while Militia training at present is purely regimental and isolated. Each regiment, even when there are several in the same county, drills by itself, and association with other corps is unknown. An experiment has, indeed, been made, last year and this, of sending several regiments to Aldershot, to be brigaded during their training with regiments of the line. This is, no doubt, a step in the right direction, but a very short one. No benefit can accrue from it to the Militia generally. There are but two camps of any size in the United Kingdom, Aldershot and the Curragh, and the distance and expense are too great, and the time too short to send to either camp any regiments except such as are in their immediate vicinity. As a matter of fact, all the regiments that went last year and this to Aldershot were within easy distance of the camp, and in some instances, the same regiments have been selected both years. But the benefit that even these favoured corps can derive from their camp life will be very trifling. Their whole term of embodiment occupies but 27 days. The first two are taken up in mustering, clothing, and arming, the last two in unclothing, disarming, and paying off; then three Sundays have to be deducted from the balance, and if every remaining day should be fine—and who is there that believes in the possibility of such a thing?—there will be twenty clear days left for moulding the Militiaman into an efficient fighting man, able to cope with an emergency at a moment's notice.

The time allotted is too short—too short, in fact, for anything but an imperfect grounding in company drill, and a superficial knowledge of a few of the simplest battalion movements, to show off on the day of inspection. The Militiaman may indeed get a slight inkling of camp life, and the Linesman may see that the Militiaman is the right material if properly handled, but beyond that but little good will be effected. But in three, or even two months, much might be done. There would be time to form temporary camps in districts where no permanent one exists, and men could, in a great measure become habituated not only to the drill but to the discipline and duty of a soldier. They would have the great advantage of being brought into close contact and fellowship with the professional soldier, and of being familiarized with a soldier's life, and I cannot but think that happy results would follow from such protracted association, that prejudice and contempt would give way to more generous feelings. The Linesman might be brought to look upon the Militiaman not as a clumsy caricature of himself, but as a valuable auxiliary; and the Militiaman would gain the inestimable benefit of feeling that he belonged to a force that was really looked upon as a Service, and which could, if called upon, take its part, though a subordinate one, in the defence of the country.

If this system was adopted, I do not think the political economist or the tax-payer would have much ground for alarm; for though the nominal strength of the Militia is 134,000 men, I doubt if there will ever be much more than 100,000 embodied in any one year: but even if the full number entered an appearance, the derangement caused by the withdrawal of 40,000 men annually for three months from the entire population of the United Kingdom, could be but slight. Many Militiamen have no fixed employments; those who have, can, as experience has proved, be very well spared by their employers for the present term of training, and the man who can be spared for 27 days in each year, can easily be spared for 81 days once in three years without inflicting any very serious loss on the agricultural or commercial portion of the community, which would be amply compensated for the inconvenience it might have to put up with, by the increased efficiency of those upon whom in some degree they rely for security and protection. Nor do I think there would be any difficulty with the men themselves. A spirit of soldiering, which is becoming stronger every day, is abroad. Even Militia soldiering is much more popular among the men than it was a few years ago, and the great majority of Militiamen whom I have come across, would much prefer a three months' to a one month's training, and would not require the incentives of additional bounties and allowances to reconcile them to a prolonged term of duty.

As to the question of expense, if we refer to the estimates, it will be seen that the total charge for the Militia for the year ending March, 1868, amounts to £986,762, including a sum of £5,565 for the pay, &c., of the Inspecting Staff of Reserve Forces (a portion only of which is justly chargeable to the Militia).

Of the total charge, the Establishment absorbs, including bounties, expenses of enrolment, &c.	£286,365
Permanent Staff pay, allowances, clothing, medical expenses	246,977
Volunteers' pay, allowances, medical expenses ..	217,700
Ditto clothing	191,720
Pay Recruits and Volunteer Non-commissioned Officers' preliminary drill..	24,000
And additional charge for those Volunteers in the Militia who may engage to serve in the Militia Reserve force	20,000
	£986,762

The first two items are fixed charges, and would be but sligl at all, affected by any extension of training. Whether the drill 1 or 27 days, the charge for bounties, general and perm staffs, &c., will remain the same. It is the number of men, ar the number of days, that determines the amount of the bountie the pay and allowances of the general and permanent Sta. estimated for every day in the year, and cannot be affected in ar by any diminution or extension of the term of training; and for tl poses of a serviceable Reserve, the fixed establishments appear tc be as complete and efficient as they need be, and require little, further development.

Then, though at first sight it might appear to do so, I think the charge for clothing (£191,720) would not vary.

A soldier of the Line receives a new uniform every twelve months, a Militiaman, nominally, every five years, but virtually every five months, as he is only called out for duty one month in each year. There is no reason why a Militiaman's uniform, making every allowance for the disadvantages he labours under, should not last nine months to the regular's twelve, and in that case no alteration as to the issue of clothing would be required. As to the shirts, socks, and boots that are supplied annually, they would be the merest rubbish if they could be worn out during the term of a three months' training.

The item of £20,000 for Reserve Volunteers would of course, under the system I propose, disappear, and the charge £24,000 for the preliminary drill of recruits (£21,000) and volunteer Non-commissioned Officers (£3,000), remain as it was.

There would then be left but the item of £217,700 for volunteers' pay-allowances, &c., which could in any way be affected by an extension of training. According to the scheme I venture to suggest, this sum would be exactly doubled, and £217,700 represent the increased annual charge for the Militia, minus the £20,000 before referred to, and there might also perhaps be a further reduction (though I would deprecate it) of £21,000 by dispensing with the 14 days' preliminary drill for the recruits.

There is, however, the Government scheme and its cost to be taken into account, on the other hand. As I understand it, 30,000 men are to be selected from the Militia force, who are to receive double bounties, and in some way, not yet made public, to be made more efficient than their fellows. The double bounties will amount annually to £30,000, and a month's additional training—and it could not well be for less than a month—would cost at the least £70,000 more. So that the difference between making the whole Militia force and a fourth of it, efficient, would not amount to more than £97,700.

But this is not all, for even if the Government scheme could be carried out without any increase of expenditure whatever, it would still be in my opinion most objectionable; for, admitting that 30,000 men were made efficient, the condition of the remaining 100,000 would be rendered far more hopeless and helpless than it is even at present. An efficient reserve, as I understand it, is a force that stands on its own legs, and is not to be cut up into small pieces to prop up the legs of another force. If you want a Militia regiment to be of any use, keep Officers and men together, and train them properly; but, if in a corps you exalt a certain number of men above their comrades, and, in case of war, detach them altogether from their regiment and merge them in the Line, you destroy the efficiency and *morale* of the remainder, and you create jealousies and heart-burnings amongst the men, and disgust amongst the Officers. It is not very encouraging to 100,000 men to be stigmatized as the refuse of a force which is sufficiently contemptible as it is in the eyes of the public, nor to zealous Officers to have the *sic vos non vobis* principle applied to them, and to have to submit to the humiliation of being considered unworthy, when real work has to be

done to lead men who had in a great measure been made efficient through their exertions. No Officer with a spark of *esprit de corps* would care to act merely as a dry nurse for the regular Army without a chance of ever seeing actual service, and neither Officers nor men could ever feel an interest in a corps which in no event, as a whole, could act together in the field. Cohesion is as essential to the Militia as to any other agglomeration of atoms. Separate its men and Officers, and it is as a bundle of sticks, whose fastening has been loosened. Shoulder to shoulder with old comrades, and led by Officers to whose control he has become habituated, the Militiaman will be turned to far better account than by the irritating and invidious system of partial selections and extra bounties. If 30,000 men should be required to reinforce the Line, there will be no difficulty in finding them, and they will, I feel certain, be obtainable without any bribe whatever. During the Crimean war and Indian mutiny, most Militia regiments (indeed I don't know of any exceptions) volunteered without any inducements being held out to them, for foreign service in the field, and meant it, too; and the same patriotic and martial spirit, rather more intensified, if anything, is alive still, and will at any moment place twice 30,000 Militiamen at the disposal of their country. And if in
emergency the entire Militia force should not be required at once,
selections had to be made, why not make selections which woul
provocative of emulation instead of disgust? In such an event
dozen of the most efficient regiments be called out in their inte
Officers and men, just as they are, into active service. Let a
regiment be brigaded with a Line regiment, instead of a fragmen
Militia regiment being merged in a Line regiment, and, I ven
say, that the result would be such a spirit of generous rivalry an
tion throughout the whole Militia force as would render extra
and inducements altogether unnecessary.

But the desired end will never be attained, let the trainin
so much extended, until the billeting system is abolished. It
less important that a soldier should be well drilled, but it is
important that he should be well disciplined. Even a
can see that the internal discipline of a regiment can never
out in the drill-field, and that it is within the barrack-walls
be thoroughly developed and enforced. *Esprit de corps*, reg
unquestioning obedience, complete subjection of the individ
more indispensable even than drill. A man may manœu
and fire straight, and have a stout heart, but if he has n
lessons of complete self-abnegation and perfect obedience,
all times, and more especially in the flurry of action, or the
hour of disaster, a very inefficient and worthless soldier;
not require to be a military man to see, that the general a
billeting system would render internal discipline imp
disorganize the best trained army in Europe, and convert
If this is the case with the dry tree, what must it be wi

How are 100,000 Militiamen, who have been runnin
the length and breadth of the land for eleven months, t
when they are allowed to run still more wildly for the re

through the towns in which they are billeted? But this is literally the case; for, practically, a Commanding Officer has no full control over his men once they leave the parade-ground. Pickets and inspections of billets, by Company and Orderly Officers, and all that sort of thing, where they are practicable, can never insure constant supervision of the men; and even these are delusions where men's billets, as is the case in many instances, are three or four miles distant from their head-quarters.

If any one wishes to see the working of the billeting system amongst the Militia, let him take an afternoon walk in any district; let us say, for instance, the metropolis and its environs, when a regiment is out for training, and see the guise in which too many of the constitutional defenders of their country present themselves. I was going to say that they look like the refuse of a disbanded army, but the representation would be far too flattering to them. It would be more correct to say that they resemble a rabble who had lately looted a military baggage train, and decked out in shreds and patches of their plunder were disporting themselves according to their various inclinations. The costermonger of the East, and the donkey boy of the suburb, may be seen pursuing, in full panoply and unrebuked, their several avocations, under the very noses of Adjutants and Commanding Officers. Here a speculative group, civilian from the waist upwards and military from the waist downwards, or *vice versâ*, are occupied in the ennobling pastime of pitch-and-toss; there a free fight between two pairs of regimental trousers, bottle-holder, a full Non-commissioned Officer, in full regimentals and billy-cock hat; further on, an omnibus, crowned with flushed warriors, rather drunk than otherwise, and mostly open as to the tunic, and cotton handkerchief as to the neck. At every corner public-house, a guard of honour hilarious, and for the most part riotous. These can be seen any day, and to say nothing of midnight orgies and the consequent sensation-headings in the public prints of—*Another Militia Outrage—Alarming Disturbance of the Peace by Militiamen*, &c., &c., ought to afford convincing proof how the billeting system trails the Queen's uniform in the mire, and stigmatizes and degrades the men who wear it.

It is with the soldier as with every other man,—our habits of life are not formed merely by what is learned from books, as a boy, but mainly by the discipline which is undergone, either at home or at school, in early days. It requires no prophet to be able to predict that a boy who is suffered to run wild out of school-hours, will come to grief in after years.

The obvious remedy for this crying evil is the erection of barracks for the Militia; and the obvious objection to the remedy is, that it will cost too much. Well, if that be the case, let only such a proportion of the Militia as can be provided with barracks, not then occupied by regular troops, or who can be brigaded together under canvas during the period of their training, be called out every year.

By that means the nation would have a small number of men worth something, instead of a great number worth nothing at all; and what would be lost in numbers, would be gained in efficiency. I doubt, however, very much if the nation would, in the long run, be at all a loser by the substitution of the barrack for the billet system.

The estimate this year for "allowance in lieu of lodgings, billet money of Officers, Non-commissioned Officers, and men, and hire of barracks"—for the Permanent Staff and Volunteer Militia amounts to £78,300, which, at 4 per cent., represents the interest of nearly £2,000,000, a sum which would go far towards housing the entire Militia Force of the United Kingdom. Indeed a letter has lately appeared in the *Times*, from an Officer commanding a Militia Regiment, stating that "an eminent architect offers to build barracks of a "most excellent and substantial kind for a regiment of 1,050 men, with "Officers' quarters, for a sum not exceeding £14,000." If this estimate is correct, 140 barracks could be provided at the cost of the present billeting system. But 140 barracks would not be required. There are many unoccupied barracks in the United Kingdom that could be turned over to the Militia, and there are many that could be occupied by the Militia during the absence of the regular troops in camps and elsewhere. Then a portion of the Militia might and ought to be brigaded during their trainings in permanent or temporary camps; and again, the trainings of three or four adjacent regiments might be consecutive, and each in their turn occupy the same barracks, which could provide accommodation for the Staffs of all during the intervals between the trainings. So that I do not think that more than sixty or seventy new barracks would be required, and a considerable margin of the present expenditure of £78,000 be still left for their maintenance and repairs.

But even if barracks be added to extended training. There is still a formidable obstacle (to my mind the most formidable) to Militia efficiency in the way. If other parts of its system require to be reformed, the officering of the Militia requires to be revolutionized, for the mode in which it is conducted, is in every respect as faulty as it well can be, and is of itself sufficient to paralyze all the vital energies of the force. As the first step to its reform, I would wish to see the patronage of the Militia remodelled. At present it is altogether in the hands of the Lords Lieutenant of Counties, and the upholders of the present system will doubtless defend it on the grounds, that as the Militia is a local force, and the Officers, country squires or their sons, who must by law possess a certain property qualification, and whose tenants and dependants fill the ranks, therefore the chief man in each county is obviously the proper person to select the Officers for his County Regiment, and that a departure from this system would, by destroying the local character and clanship of the Militia, thin its ranks, and impair its efficiency This was the idea no doubt on which the Militia system was originally based, and a very good idea 200 years ago, when, though the sun of chivalry had set, the glow of its parting rays were still felt throughout the land, when feudal traditions and influences were still potent, when most country gentlemen knew more or less of soldiering, when there was no manufacturing or floating population worth talking of, and tenants were more dependent on and attached to their landlords than they are at present. But it is a worn-out, effete, and utterly impracticable idea now-a-days. A Captain of Militia does not now grow his company on his estate, and bring it with him to the annual trainings; many of the men, in some cases all, are strangers to him, until he meets them on parade, and few and far between, are the faithful clansmen, "who follow to the field their warlike Lord." There is no balloting for recruits now-a-days, and consequently no occasion to make compulsory service palatable to an unwilling recruit, by placing over him men whom he has known and to whom he has been attached all his life. The fact is, that the Militia is altogether recruited by the Adjutant and the Permanent Staff, men who for the most part have no tie or connection whatever with the county in which they are stationed, and who pick up their men by means of the blandishments and allurements, ordinarily had recourse to by recruiting parties for the Line.

Nor are the officers invariably county potentates; some certainly are, and I wish there were more of them, but in many instances Officers of the Militia have no more connection with the locality in which their regiments are trained, than Officers of Line regiments with the localities in which they are quartered. They appear on the first day of training, no one knows whence, and disappear on the last, no one knows whither, and most probably are neither seen nor heard of again until the next annual muster. I do not know how the question of qualification is got over, but it is somehow, for denizens of every quarter of Great Britain may be found sitting at the same mess-table, many of whom are as devoid of any property qualification whatever, as they are of local connection with their regiments; nor are instances wanting in which the Sister Isle supplies Officers to English regiments, not a few of whom, and some of superior rank, are in their own country, officials in professional or public offices with small salaries, and still smaller private means, and who could not possibly afford to retain their commissions, if their regiments were called out for active service. But even this infringement on the principle of local appointments has failed to secure a sufficient complement of officers. For though "the "further appointments of Ensigns and Second Lieutenants in Militia "regiments have been suspended," there are still in the reduced establishment of Officers nearly 1,000 vacancies, and every day it is becoming more difficult to induce any one to accept a subaltern's commission in the Militia. There are at present actually six regiments who have not a single subaltern amongst them, and twenty-four who have not more than two each.

But if the arguments in favour of the present system are out of date, the objections to it are not. It is manifestly detrimental to its efficiency, that the appointments and promotions of a military force should be altogether in the hands of country gentlemen, for the most part totally innocent of any acquaintance with military affairs. To be merely the nominees of a Lieutenant of a County, is in itself a deterrent to many gentlemen, who would not only willingly accept, but seek a commission, if, as in the Line, it proceeded directly from the Sovereign; and this is one amongst many reasons, why a Militia commission is so little valued, that few officers care to assume the titles of their rank, except during the brief period of training. We are all accustomed to, and wish to avoid the supercilious elevation of the eyebrow with which Captain So-and-so of the Militia is received by his brethren of the Line. But that is not the worst—the *pitchforking*, which is the necessary consequence of the present system, is still more galling and pernicious. The Lord Lieutenant may virtually appoint or promote just as he pleases without reference to regimental fitness or seniority. The civilian of to-day may, and sometimes is the Colonel Commandant of to-morrow, and grizzled Field Officers of many years' standing touch their caps to, and "Sir" beardless boys just emancipated from school and college—

> "That never set a squadron in the field,
> Nor the division of a battle know
> More than a spinster."

and mushroom commanders of companies are such every-day occurrences, that a covering serjeant would be quite taken aback, if his newly-appointed Captain could face properly on parade without assistance. Within the last few years indeed, a recommendation—it can scarcely be called an order—has been issued, that promotion should go by seniority, except under peculiar circumstances, but the order has been "more honoured in the breach than the observance," and the evil has been but very partially checked. It would be waste of time to comment on the results. They are self-apparent, derision and contempt from without the force, from within, heart-burnings, jealousies, disgust, resignations, and inefficiency. All this might be avoided if the feudal idea was modified so as to suit the requirements of the present day. For it is with the State, by its blind adherence to the feudal idea, and not with the Lieutenants of Counties, that the blame lies. They but administer the system as it has existed and been sanctioned, and indeed encouraged by authority for two centuries; and though their appointments may have been in some cases detrimental to the Militia service, they have hitherto been in accordance with the Militia system. I should be sorry to see the connection between the Militia of a county and its Lieutenant severed, or the local principle of officering abandoned; for though the Militia is not now recruited by its officers, still more cordial and intimate relations are likely to subsist between officers and men, when both are of the same county; and an officer who in his civilian capacity has been looked up to, and respected by the privates of his regiment, has opportunities, if he will but use them, which no stranger could possess of exercising a beneficial influence over their character and conduct whilst under his command. It is because I attach great importance to the maintenance of the local principle, and believe that it would be strengthened and confirmed, if the status of the officers was improved, and appointments and promotions proceeded from a higher source, and were less capricious than at present, that I would strongly urge, that while the nominations to commissions should remain in the hands of Lieutenants of counties, the final appointments and all future promotions should be under the control of the Commander-in-[illegible] that the commissions should be the gift of the Sovereign, and [illegible]bject; and that pitchforking being done away with, every Officer, Squire or not, should begin at the lowest rung of the ladder, and that promotions should be regulated as they are in non-purchase regiments of the Line.

I do not apprehend there would be much difficulty with the Squire in these days, when soldiering is returning to its old rank as a national rather than a professional pursuit, and men of wealth and position throng the Volunteer ranks as privates. No man of spirit would object to enter the Militia as an Ensign merely because he happened to be a county magnate. Make the Militia a Service that they can take pride in, and I venture to say there will be no lack of country gentlemen amongst its subalterns. But every man cannot be a Squire, and the Squirearchy is not sufficiently numerous of itself to officer the Militia. To fill the gaps, therefore, it must be supplemented by a class as to whom there would still be a great difficulty, namely, the men of small means who have their way to make in the world, and who cannot afford to fritter away their time in profitless pursuits—such men have at present every reason in the world for avoiding the Militia. It is a source of present expense, and holds out no hopes of advancement for the future. It offers them no opening in life, it is a complete *cul de sac*, and a road that not only leads nowhere, but that diverts the footsteps of many a young man from paths which would lead to profit and honour. For while Volunteer-soldiering is merely the occupation of leisure hours, and has become so blended with his other pursuits as to form part of the daily programme without interfering with the business of a man's life, Militia-soldiering while it lasts, is pure and simple soldiering, out of which all civilian element has been eliminated, and it lasts long enough and is pleasant enough to unsettle many a young mind, and give it a distaste for the sober occupations of its ordinary civilian life. But if by any means the Militia could be made to forward a young man's interests in life, if it could be the stepping stone to a military career, and that a certain number of direct commissions could annually be given amongst those subalterns who do not possess the necessary qualifications for the higher grades; if Militia service could count for something, say two years for one, in the cases of those who pass from it into the Line, then, I think, the difficulty as to Militia subalterns would speedily be got rid of.

Never having been a Linesman I throw out this suggestion with great diffidence, not knowing whether from a military point of view it would be possible, but I trust that some such encouragement may be given to Militia subalterns, for without it I do not see how the gaps in their ranks are to be filled.

But even if the gaps were filled up, and the appointments and promotions all that could be desired, the Officers will still remain a blot on the Militia System, if more attention be not paid to their military education. At present it is lamentably neglected. There is absolutely no provision made for training the Recruit Officer. The Adjutant and permanent staff are barely sufficient to look after the privates, and have as much and indeed more than they can do to get them into presentable trim for the inspection day. The Officers are pretty nearly left to themselves, and may learn their duty as best they can, if they cannot learn it at all, and the consequence is, that very few of us know more than the alphabet of soldiering, if we even know that. We are not indeed so disgracefully ignorant as we were during the Crimean war, and some little pains are now taken with us, but even now, there may be found Field Officers who read off words of command from cards pinned to their holsters, and Company Officers who are the mouthpieces of their Covering Sergeants, and there are few, if any of us, except such as have been formerly in the Line, who are competent to take charge of men in the field, or within the barrack walls; in fact, generally speaking, the men know much more than their Officers, while exactly the reverse should be the case, for if the steadiest and best disciplined troops require to be well led, *à fortiori* the Officers of an imperfectly trained force such as the Militia, ought to be men thoroughly well up to their work, and who could command the respect and perfect confidence of their men. A half-trained Militiaman may to a certain extent be serviceable if commanded by a well-trained Officer, but a half-trained Militiaman commanded by an incompetent Officer is worse than useless, and in the Militia, of all Services, lions should not be led by asses. Until the Officer, even better than his men, and at the head of his men, is available for active service at a moment's notice, until in times of emergency and danger, the Militia force can be safely intrusted to Militia Officers, it will be impossible to convert it into an efficient Army of Reserve; for on the first outburst of war men would be separated from their Officers, and drafted by fragments into the regular Army, and the Militia would revert to the ignominious position it occupied during the Crimean war, of being a mere feeder for the Line.

I have a strong impression that the efficient service of the Prussian Landwehr in the late campaign, was mainly attributable to the fact that the men, who after all were but imperfectly trained, were led by Officers who had received a thorough professional education prior to appointment, and who, though totally distinct from, were not one whit less efficient than the Officers of the regular Army; we may thus learn from Prussia how to provide for our first reserve a body of efficient Officers trained in all the duties of the Line. In that country in the Landwehr of the first call, which is in reality what our Militia pretends to be—the support of the Standing Army in case of war—commissions are laid open without distinction of class, and the Officers are a truly national body, but every candidate has to produce before a mixed military and civilian board, certificates of age, means, consent of parents, conduct and attainments, and if these testimonials are satisfactory, to undergo (unless he be a student from the universities or certain royal schools) an examination in German, Latin, French, Mathematics, Geography, History, and the elements of Natural History and Physics. If he passes, he receives a certificate and is posted as a cadet for twelve months to a regiment of the line. During the first six months he serves as a private soldier, and is chiefly occupied with recruit's drill. In the next six months, if perfect in drill and a private's duties, and has passed a practical examination in Surveying and Gymnastics, he receives the grade of Corporal, and is instructed in the duties of an Officer. Three weeks before the end of the twelve months' service he has to appear before a regimental board, and is tested, first, orally indoors; secondly, in the field; and thirdly, by written papers on all the ordinary duties of a subaltern in field and garrison. Should the result and the Cadet's personal qualifications prove satisfactory to the board, and the other Officers of the battalion, he receives a certificate which entitles him in due time to a commission in the Landwehr battalion of his own district.

From this we may see what importance is attached in Prussia to the professional training of Militia Officers, and the late German war affords proof that the importance has not been overrated.

Though, for obvious reasons, we could not in this country apply so crucial a test, and the elaborate Prussian system of *Einjahrige* affords facilities for educating Officers which we do not possess, still I think a modification of the Prussian training might be adapted by us with advantage; and indeed in a very small way, we have already taken a step in that direction. A Militia Officer may now, if he makes application, be attached for one month's training to a regiment of the Line. This is all very well as far as it goes, but it is open to two fatal objections—

1st. The time is too short.

2ndly. The training is purely voluntary.

Nothing can come of a month's training even in the best of schools; and where the voluntary principle is applied to education, I fear the number of scholars will be very limited. Besides which "a little "knowledge is a dangerous thing," and the smattering of soldiering thus acquired, not unfrequently turns the recipient's head and makes him intolerably cheeky, and self-sufficient, and insufferable when he joins his comrades of the Militia. To effect any good the professional training must be more thorough, and I would venture to suggest that no nomination for a Militia commission should be confirmed, until the candidate previously approved of by the General of Reserves had as a Cadet gone through a regular course of training with a line regiment for six months at least (I wish it could be for twelve), and at the end of that period had obtained a certificate of efficiency after a searching examination by a military board.

If the commissions were made contingent on the certificate, sham Officers would become an impossibility, the chaff would be sifted from the wheat. We who hold our commissions, though we think them a bore, because Lord So-and-so pressed them upon us, or because there was always a Major or a Captain in our family, or on account of the uniform, or because we like the fun of playing at soldiers for a month every year, should disappear, and our places be filled by working men, well up to their work. It may be that our places would not be easily filled, that the test is too severe, and that the asterisks in the "Army List" would be increased instead of diminished, but even if it were so, and that the gaps were multiplied tenfold, I would still be an advocate for thorough professional training. A battalion with but three zealous Officers who knew their work, would, I venture to assert, be more efficient than one with a full complement of such Officers as we have under the present wretched system. I do not, however, anticipate that there would be any falling off. Let the Militia be once made a SERVICE, and it will be found that there are still enough spirited gentlemen left in old England to officer her First Reserve, notwithstanding the preliminary discouragement of professional training.

I have not been able to ascertain with precision the annual average of Militia appointments, and therefore the expense of the professional training scheme suggested must be in a great degree a matter of conjecture, but I do not think that in one year there would ever be more than 200 candidates for Militia commissions, and if each cadet during his probationary course received the allowance of 5s. per diem now given to Militia officers while attached to the Line, the total annual cost would be something under £10,000; to my thinking not too high a price to pay for obtaining efficiency in the officers of a First Reserve.

In these remarks I have confined myself altogether to the consideration of the possibility of converting our present Militia into an efficient Reserve. I do not feel myself competent, nor will I venture to enter into the general question of Army Reserves, but I trust I may not be considered presumptuous if, as an outsider, I express a hope that the services of those men who leave the regular Army in the prime of life may in some way be secured for the Militia. It is lamentable to see 4,000 or 5,000 as fine men as ever stepped, lost annually to the country, who, if diffused through the Militia, would leaven the whole mass with the leaven of true soldiering; and if it were practicable that every soldier who re-engaged to complete, say 25 years, was bound to serve 15 years in the Line and the remaining ten in the Militia of the district to which he originally belonged, a most valuable infusion of seasoned soldiers in the full vigour of manhood would be secured for every Militia regiment in the United Kingdom.

Now, with respect to the whole subject, I am very sensible that the crude suggestions I have ventured to offer are open to many objections, but even if they were unimpeachable in other respects, I feel that they, or any other scheme by which the estimates would be increased, will be met by an objection which, for some time at least, will be a lion in the path, and which can be summarised in one word—Abyssinia. But this is an objection which applies with equal force to the Militia, as at present constituted, and the same prudential reasoning which would deter us from making the Militia efficient should also prevent us from throwing away a million annually on a perfectly useless force. It may indeed be said that though worthless as a military force, it still has its use as a nursery for the Line. On that point I will merely observe that the estimates for the Militia this year amount to £986,762, and the total charge for direct recruiting for the Line to £103,258, that the number of recruits finally approved for the Army during the years 1863, 64, and 65 was 42,457, giving a yearly average of 14,200 recruits, of whom more than four-fifths were obtained by direct recruiting, indeed in the six months from July to December, 1859, out of the exceptionally large number of 14,000 recruits finally approved, but 1,002 were enlisted through the agency of the Militia, so that if 10,000 recruits obtained direct by the Line cost but £103,258, while 1,000 or 3,000, or 4,000 recruited by the Militia cost £986,762, or even if the Militia recruited man for man with the Line, it can scarcely be considered an economical or satisfactory nursery for the regular Army, and it appears to me that there are but two courses left for us to adopt with respect to it, either to make it efficient or to abolish it altogether. Either alternative is preferable to the perpetuation of the present costly delusion; but the first will, if I mistake not, be found in the long run to be the better and the cheaper of the two, for that ugly problem, how with 10,000 men to meet him that cometh against us with 20,000 men, still stares us in the face, and sooner or later we shall have to deal with it, either by making the Militia more efficient as a Reserve, or by a material increase of the standing Army. I can see no middle course, for if the Militia do not furnish a very considerable portion of the materials for a Reserve, I do not see where sufficient materials are to be found elsewhere.

There is no one who estimates the value of the Volunteer force more highly than I do. I look upon the Free Lances of England as a tower of strength to the country, and though they have completely taken the wind out of our sails, I do not grudge them in the least their well-merited popularity. But they can never form a *First Reserve*.

The functions of a *First Reserve* are, in time of war, to release the regular forces from garrison duty at home and in the colonies, and to take the field whenever and wherever it may be called upon, and these are functions which the Volunteers are unfitted to discharge except for a spurt with an enemy at our very gates. Then, the Army of Reserve Force, as constituted under the warrant of 1859, has been a complete and admitted failure, and the pensioners are, for the most part, stale and numerically insignificant, and if the nation will not utilize the materials for a Reserve which they possess in the Militia, and is still bent on solving the ugly problem, I see nothing for it but a large increase to the standing Army. In a word, we have three courses to pursue, to make the Militia an efficient First Reserve at a moderate expense; to increase the standing Army at an immoderate expense; or to abolish the Militia, save the money it costs, and trust the future of the British Empire to the mercy of events, and to the forbearance of the great Powers of Europe.

Evening Meeting.

Monday, January 18, 1869.

REAR-ADMIRAL ERASMUS OMMANNEY, C.B., F.R.S., in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 18th January, 1869.

ANNUAL.

Clutterbuck, Thos. St. Quintin, Lieut. 29th Punjab Infantry. 1*l*.
Sullivan, T. D., Lieut. late 56th Regt. 1*l*.
Hanson, Joseph, Ens. late 1st Surrey Rifle Volunteers. 1*l*.
Schomberg, G. A., C.B., Col. Com. Roy. Marine Art. 1*l*.
McMahon, C. J., Capt. Roy. Art. 1*l*.
Turnbull, H. C. M., Lt. 6th Roy. Regt. 1*l*.
Nicolson, Frederick, Lieut. Roy. Art. 1*l*.

INGLEFIELD'S NEW HYDRAULIC STEERING APPARATUS, AS BEING FITTED TO H.M.S. "ACHILLES."

By Captain E. A. INGLEFIELD, R.N., F.R.S.

ONE of the leading Naval journals in commenting upon my hydraulic steering apparatus, which is now ordered to be fitted on board Her Majesty's ship "Achilles," made the following remarks, and I think them so much to the point that I shall take the liberty of quoting them:—

> "In all fighting ships there is one especially weak point which, if successfully assailed by the enemy, at once places the vessel *hors de combat*, and leaves her entirely at the mercy of the enemy. This point is the steering apparatus, the destruction of which leaves the ship a useless log upon the water, unable even to run away, unless Providence had previously placed her head in such a position as might admit of such a manœuvre being possible. No matter what may be the perfection of every other part of the ship, no matter though her battery be impregnable and armed with irresistible weapons, all can be rendered absolutely useless by one well-directed blow at the steering apparatus, which in all vessels, whether old-fashioned or new, is more or less exposed. Not only is the apparatus exposed, but the men at the wheel, put them where you will, are liable to be swept away, and the ship at a critical moment left helpless, either before an evil-disposed enemy, or in the vortex of a storm."

To Naval Officers this must have been an oft-recurring thought, and it is to overcome this serious weakness in our fighting vessels that a process of hydraulic steering-gear has been proposed and experimented upon in various vessels of Her Majesty's service, and in some few of the large passenger steamers.

A slight description of those forms of hydraulic steerage which have been tried, but which have failed to comply with all the conditions expected in a perfect form of such apparatus, will perhaps be the best introduction to the subject I have now the honour to bring before the members of this Institution.

In all descriptions of hydraulic steering apparatus, the motor power has been invariably steam—a steam-engine generally placed in the engine-room to work pumps which were to supply the hydraulic cylinders.

In the drawing now before you is shewn the usual process by which the power was applied; in some cases a short back-action tiller has been employed, whilst in others, according to convenience and space, a tiller shipped in the usual manner, but of much smaller dimensions.

In the "Warrior," which was one of the first of Her Majesty's ships fitted with an hydraulic steering gear, a back-action tiller was fitted, and the pressure cylinders were laid on suitable beds in the Captain's after-cabin; the short tiller was moved by the piston rods of the hydraulic press, and these were set in motion by means of pipes which were led from the pumping engine to the pressure cylinders.

It was found, however, that there was a want of uniformity in the action; that, for example, the engine was not always ready, as steam was not always up, and unless kept constantly in motion—pumping water to waste,—there was a condensation in the cylinders of the pumping-engine which prevented immediate action.

To remedy this defect it was suggested to fit an accumulator such as are supplied for hydraulic lifts, and as in the case of the new Birkenhead Docks, to open and close the gates.

Two accumulators were supplied to the "Warrior," and these cumbrous machines made to contain water were placed in the bread-room, and heavy weights,—upwards of five tons each,—on movable pistons, imparted the velocity to the column of water, and which was nearly equivalent to the pressure when pumped by the engine.

The accumulators were kept charged by the pumping-engine, and were thus always ready for use, and certain in action.

In the trial trip with this apparatus, I am told the action was satisfactory, but there was a steam-engine required, and constant attention necessary as to the condition of the contents of the accumulators; it required also the continual presence of an engineer or a leading stoker to start and stop the pumping-engine.

Whether these were the objections which caused the Admiralty to reject this form of hydraulic steering apparatus I am not aware: suffice it to say that shortly afterwards, the hydraulic steering apparatus was taken out of the "Warrior," and for a time the subject was neglected, at least in the Navy.

The well-known engineers, Messrs. Humphreys and Co., however prevailed upon the Admiralty to try their patented process for hydraulic steering, and accordingly the "Minotaur" was fitted by them, and all that good workmanship and scientific skill could render to make success certain was brought into play; still the steam pumping-engine was a part of their plan, and constancy in action was obtained by keeping the pumps continually at work—but to waste—awaiting the moment when the long lever worked by two men on the upper or main deck opened the communicating valve to the pressure cylinder, which in this case was single, with a pull and thrust motion on the short tiller.

Having been ordered by the Admiralty so far back as 1865 to send in estimates and plans for fitting the "Warrior" on my principle, I happened to be at Portsmouth taking measurements on board that ship at the moment the "Minotaur" arrived at that port from her first trial trip, and, going on board, I enquired of the officers and quarter-masters if the working of this new steering gear was satisfactory; they replied that it required at least two men to move it, and did not work instantaneously enough, but that when it did start it was very powerful in its action, but not easily controlled.

Now I know not whether these difficulties could not have been overcome, but the principle remains the same, the steam-engine motor and the cumbrous nature of the machine and lever requisite to set it in motion.

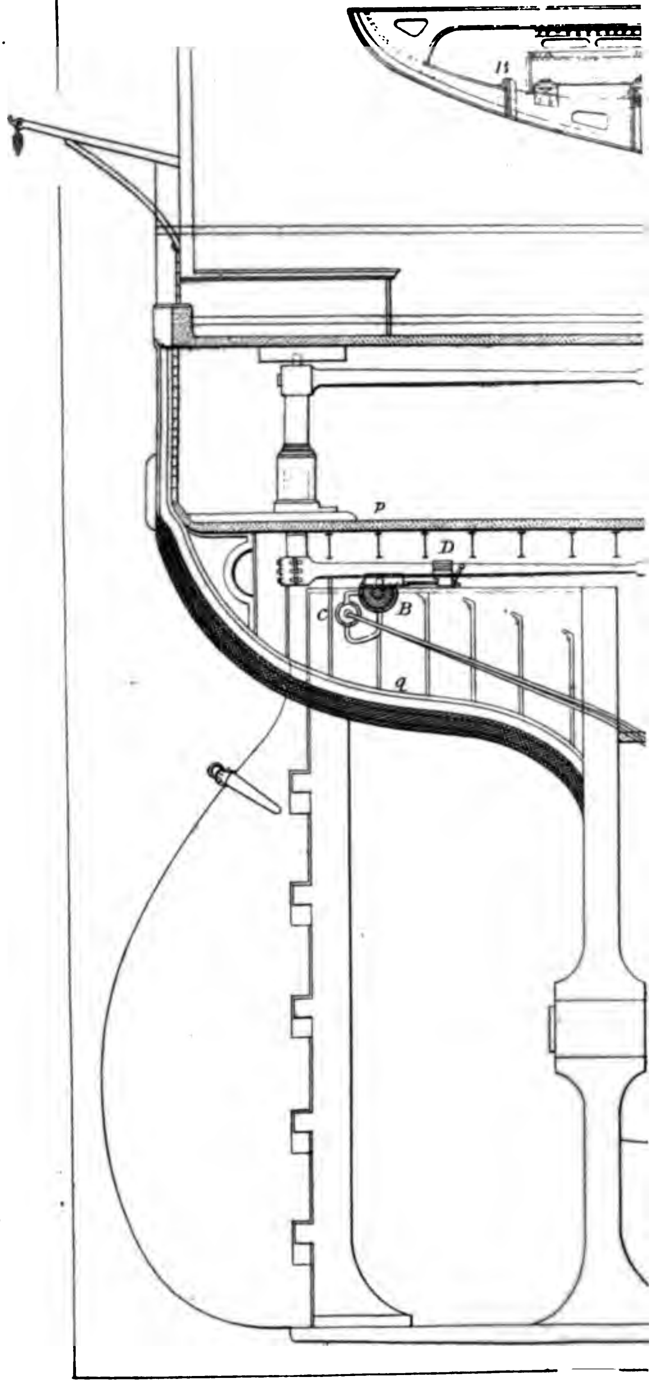
In the notice in the "Times" of Saturday, Sept. 9th, 1865, regarding this apparatus, it was remarked that, "so far as those results went, "they not only gave a great inferiority to what was obtained from the "ordinary steering-wheel, but they were infinitely inferior in every "respect, the most forcible illustration of which was, the utter absence "of controlling power in giving or checking the force from the ram "piston to the rudder-head. Hydraulic steering of ships will be a "grand innovation upon the old-fashioned wheel, rope, and tiller "system, if in the former system it can be as evenly applied and "checked as in the latter."

There is still another kind of steering gear which has been lately tried with very marked success as regards power and facility of control. I allude to one which has been lately fitted in H.M.S. "Northumberland." This, I am informed, consists of a steam-engine which is employed to move a barrel on which the usual tiller ropes are wound; but here is still the steam-engine, and, added to that, the long tiller and the ropes.

In the form of hydraulic steering gear which I have invented, and which I propose to distinguish from those I have described by the term *hydrostatic* hydraulic, in contradistinction to the *steam* hydraulic, the motive power is that which exists in every ship, under all conditions when afloat, and variable in force only as the draught of water of each vessel.

It will be understood from the foregoing that I allude to the pressure of water at the bottom of the ship, and I look upon and treat this pressure just as a vast and inexhaustible accumulator.

It is clear that this pressure (which is measured as an ordinary column of water), roughly estimated at ½lb. per square inch per foot of draught, would be equal to about 10 lbs. in a ship drawing 24 feet of water. I say only 10 lbs., as the water admitted through a Kingston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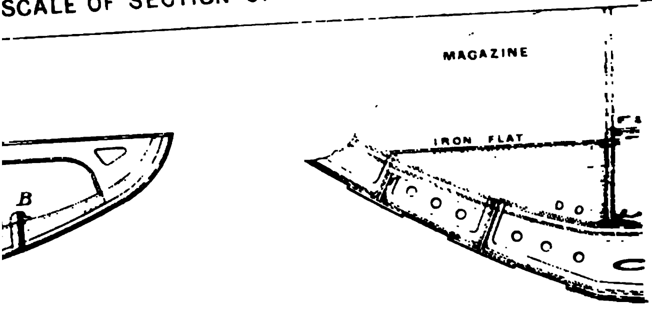
SCALE OF SECTION OF H.M S "ACHILLES" AS BE



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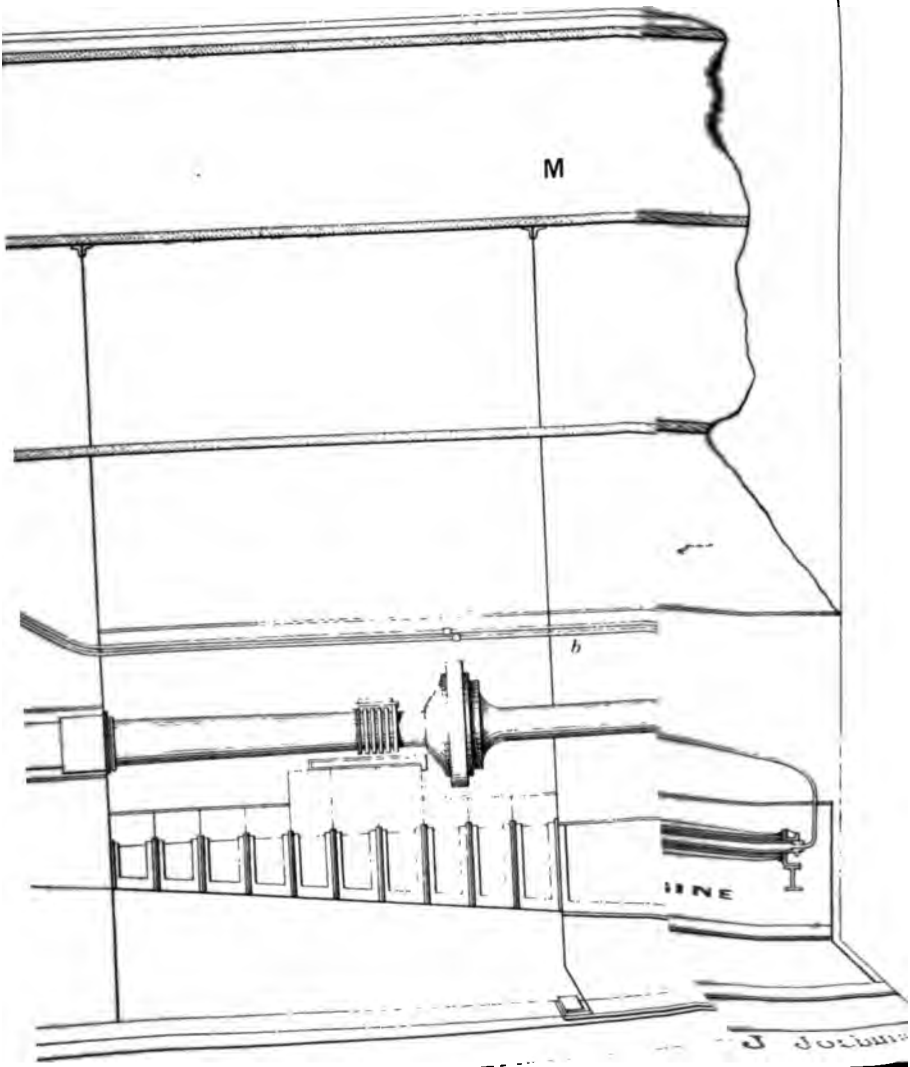

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valve could only be made available at a depth of about 20 feet in the hold of the ship. K, Fig. 2, plate I.

Now I employ this power to work a pump of a peculiar character.

In the drawing before you may be seen the pumping cylinder, which lies on the keel of the ship, and on one side of the strong back. AA, figs. 1 and 2.

The internal economy of this cylinder may be thus briefly described:—

Its piston rods are fixed and hollow, and are in direct communication with the wrought iron pipes which lead to the tiller cylinders at the tiller-head.

Now, I cause the action of the piston, which is moved backwards and forwards in the cylinder, by changing the direction of the exterior column of water, coloured green (*a*, Fig. 1), admitted through a Kingston valve, to force the column of constant water, which I have coloured pink (*b*, *b*, *b*, Fig. 1), to the starboard or port-tiller cylinder (B, Figs. 1 and 3), and thus to act on the rods connected to the short tiller; or, as in the "Achilles," to a carriage placed at a short radius on the lower tiller.

Now, the power thus concentrated at this point is for a 2 foot 6 in. radius, equal to about 60 tons—a huge force, only required when the ship is going at a great velocity through the water, and therefore it might be considered—and fairly—a great waste of power when proceeding at a slow speed.

I meet this objection, however, by a simple arrangement of two three-way cocks on branch pipes to the tiller cylinders (C, Fig. 1). By this plan I adapt the power to be exercised according to the speed, to do one or two-thirds of the work in the tiller cylinders, and by a single lever on a dial plate, the quartermaster is able to adjust this power for a 5, 10, or 15-knot speed.

The water which entered the power-cylinder at a pressure, having done its work, must be disposed of. To do this, I have a jacket enclosing the eduction valve, and which coming over the side of the cylinder, not only forms a ready channel for its egress into the bilges of the ship, but also acts in some measure as a syphon, thus drawing off the dead water from the emptying sides of the piston, or end of the cylinder. The bilge-pumps carry off this waste water, but, if preferred, a common lift pump, worked by an eccentric on the screw-shaft, will keep this waste water constantly pumped out.

To estimate the quantity of water thus admitted, I have made the following comparative calculation. The "Warrior," when steaming at the rate of 14 knots, admits on an average about 36 tons, or 720 cwt. of sea water per minute into her condensers. This implies of course that the same amount of water, less the feed, has to be pumped out again by the engine which it has assisted. Now, if it were required to put the helm of the "Warrior" down four times in the hour, there would be expended for my hydraulic-power-cylinder 44 cwt. once in 15 minutes, or at the rate of 3 cwt. per minute constantly. The ratio is, therefore, 240 to 1; that is, 240 times the quantity of water is admitted into the condensers, that would be admitted into the hydraulic; this, if thought safer, could, after use, be retained in a closed tank, which might thus correspond so far with the condensers, and from thence be either withdrawn by the bilge-pump, or, by what I at first proposed, a common plunger-pump, worked by an eccentric fitted in a convenient position on the screw-shaft.

I have thus estimated roughly the quantity of water employed in the service of steering the ship at *full speed.* I have here a drawing of full dimensions of the three-way cock, which has been constructed by my ingenious friend Mr. Renton, an engineer to whom I am indebted for much that is novel in carrying out my plans. This three-way cock, which I have before alluded to, is situated in a convenient position, so as to be easily accessible to the quartermaster, and by its use a great saving is effected at slow speeds of the power *I must* employ at full speeds to ensure rapidity of action. But even this I have modified, for it occurred to me that,—as every seaman must have witnessed,—in righting the helm, no manual labour is required, but that the action of the passing column of water upon the surface-area of the rudder exerting a great force, the controlling power has only to be released, and the helm will right itself; so I would make a similar arrangement to economise power in this plan, and to meet this, a slide of a peculiar kind has been constructed, which, at the middle point of its motion, opens a free passage through itself between the two directing tubes.

By this method, nearly one-half of the original quantity of which I first spoke is saved under all conditions of steerage; and again, more than another third of the remaining quantity, taking a long average, through the economising process brought into action by the three-way cock.

To form some conception of the force necessary to be exerted at the short tiller used for steering by hydraulic power, I may say that the pressure necessary to be exerted to put the helm over in a minute is about 50 tons; and this after allowing 25 per cent. for friction.

In the "Achilles," the arrangement of the beams and strengthening carlins obliges me to take a longer radius than was proposed for the "Warrior;" consequently the pressure in the tiller cylinders will not be more than about 35 tons, and the length of the stroke under 5 feet.

It will naturally be asked by naval men—how do you propose to steer, should the hydraulic be disabled? My reply is, that the original tiller existing still *in situ*, the tackles may be shackled, and steering resumed as before, by the wheel and ropes.

The gear I employ to connect and disconnect the hydraulic is shown in this sketch (D, Fig. 1) and may be described as a movable fork sliding by means of a coarse-threaded screw upon the tiller to grasp a pin, and this being placed on the underside of the tiller no derangement would be likely to ensue should the ship strike her rudder on the ground, for the tiller would then be lifted up clear of the fork.

In summarizing the foregoing, I desire to say that the advantages I claim for my system are as follows:—

Firstly, the employment of the vast accumulation of the exterior fluid pressing against the ship's bottom to work an engine which shall convey a power upon hydraulic principle to the tiller head.

Secondly. As this accumulator power always exists under all possible conditions of a ship afloat, and is constant and regular in its action, I can avail myself of it at any moment in large or small quantities, with *certainty* of immediate action, however long it may have been unemployed. This is what I claim as the great advantage over a steam-engine, which naturally can only be brought into play when the steam is up, and as in the "Minotaur" must be kept pumping in water to waste, that it may be ready when required for use. The engine-room space occupied by this "*steam-pumping engine*" is moreover saved by the employment of my *water-pumping engine*, as I place the latter on the keel of the ship, in a spot wholly unemployed and unadapted for any other purpose.

Lastly, the incompressibility and incondensibility of water compared with steam is another feature to my mind of no small importance in its application to the purposes proposed.

It has been suggested that a seaman accustomed to steering a vessel by the ordinary wheel might be at a loss how to manipulate the steering gear of the hydraulic apparatus. I have therefore arranged a small wheel which is made to act on the valve rod by a simple mechanical movement. This wheel, placed in the pilot house on the bridge or rifle tower, the steersman only requires to move a few spokes either way in order to shift the helm; and on putting the centre spoke amidships, the helm is righted by the self-acting process I have before described. By a bell crank action, I propose that the slide rod may be moved at other parts of the ship, and I have proposed that a small indicator, which is moved by an endless chain passing round the rudder head, and a wheel of corresponding dimensions should be placed immediately under the eye of the man at the helm.

As a contrast between the physical power employed in putting the helm hard over when the ship is going 14 knots, if steered with the ordinary wheel and tiller ropes, I may instance, that in the "Prince Consort," it required eight men crowded into the wheel, and twenty-eight at the relieving tackles in my cabin to get the tiller over in a minute and a half; whilst in the form of steering gear, I have now proposed, no more force is necessary than can be *readily applied by a boy.*

If I have failed in making myself quite intelligible with regard to the various parts and working of my engine, I shall now be happy to reply to any questions, and shall be very glad to have the opinion of Naval Officers upon the subject.

The **Chairman**: We have had a very clear description given of this steering apparatus, and I invite gentlemen to discuss the subject, or to offer any observations.

Captain **Horton**, R.N.: I should like Captain Inglefield to explain whether there is any other way of moving the helm besides the little wheel that he has described?

Captain **Inglefield**: That will be the only means of steering a wheel two feet in diameter.

General **Boileau**, F.R.S.: I think you said the length of the stroke of the cylinder was five feet?

Captain **Inglefield**: Of the tiller cylinder.

Major-General BOILEAU: Might I ask if that would be sufficient to put the helm hard over?

Captain INGLEFIELD: Yes; it is calculated to put the helm against the cabin bulkhead. I may add that the principal advantage of the plan I propose is, entirely to dispense with the steering wheel, where usually a number of men are placed. It would do away with the wheel, ropes, and the 15-foot tiller.

Lieutenant A. GILMORE, R.N.: I may remark that by your method you release one gun's crew.

Captain INGLEFIELD: A whole gun's crew at least; and, moreover, the men are placed in safety.

Navigating-Lieutenant J. RICHARDS, R.N.: I should like to ask what arrangement Captain Inglefield proposes, when the helm is moved amidships, to prevent it flying over to the other side if the ship is rolling? because in the ordinary tiller the opposite ropes have a checking power. What is proposed to retain the helm amidships, because when it is relieved it will fly over to the other side?

Captain INGLEFIELD: Not if the ship is going through the water. If the ship is going fourteen knots an hour, the helm will remain amidships; but the man has an indicator before him, and the instant the helm is righted, he can lock it, by putting the slide in such a position that the water cannot move in either of the tiller cylinders. Perhaps it will be better to explain that when the ship is going to sea the only process necessary is to open the Kingston valve, the Kingston valve being open, the sea then has free access to the pumping engine, but nothing is done until the rod admits the water into one or other of the tiller cylinders, and the moment the water has been checked from going into one of those pipes, that moment all action ceases. The man might leave the wheel and go away; the water is locked in the tiller cylinders, the pumping-engine can neither work, nor can alteration take place in the water which exists in the two tiller cylinders; the engine stops immediately, because there is nothing for it to do.

Lieutenant RICHARDS: That does not appear to me to check the play of the rudder instantly?

Captain INGLEFIELD: Yes, the moment the water is locked up in the two tiller cylinders it is impossible for the rudder to move. Water is an incompressible fluid. It is positively locked into the two tiller cylinders, and the helm is even more rigid than it could ever have been with ropes.

Lieutenant GILMORE: For the rudder to move it must burst the cylinders?

General BOILEAU: They form, as it were, incompressible buffers?

Captain INGLEFIELD: Exactly so. There is an advantage which I consider water has over all other things. In the "Northumberland apparatus," steam was used to move the tiller ropes, but the power was so enormous that in the case of the "Great Eastern," where it also was used, the chains were carried away; the chains were rendered almost too rigid by this immense power. The inventor, therefore, prefers using a strong rope.

The CHAIRMAN: What is the position of the bridge in your plan?

Captain INGLEFIELD: I have made these drawings from the ordinary Admiralty drawings. Here is the pilot-house, where the Captain stands. My arrangement brings this rod inside the armour plate. The "Achilles" is armour-plated only as high as the main deck, then there is a belt all round the ship enclosing the battery. This rod is brought up just inside that belt; the armour plating protects the whole of my apparatus.

Captain HORTON: What would be the effect were the pilot-house shot away?

Captain INGLEFIELD: I propose that there should be several other means of moving the rod. On the main, upper, or lower deck you may have similar wheels: any motion that will move it up and down six inches will do. I have also suggested that it should be carried, by means of a bell crank lever, to the other end of the bridge, so that the Officer of the watch may put his hand upon the lever, and, without calling the Quartermaster, put the helm down himself; a bell crank lever will move the rod up and down six inches.

Lieutenant GILMORE: Would that do?

Captain INGLEFIELD: Yes, because I propose that the action of one should correspond with the action of the other. The chances are that the helm would be amidships, and then it would be locked, and the Captain could move it independently.

Lieutenant **Gilmore**: Would your plan be applicable to the ordinary wheels we have now, one on each deck—the fighting wheels?

Captain **Inglefield**: Certainly.

Lieutenant **Richards**: How do you propose to get rid of the waste water, if the apparatus is used whilst the ship is under sail?

Captain **Inglefield**: That is one of the conditions that has not been generally entered into, because steering by an apparatus of this sort has not hitherto been applied. It is presumed that the ship is going into action or manœuvring, and that the steam is up, as is the case in all men-of-war. I have considered that question apart from this process of mine. I propose that in all steamers, abaft the disconnecting gear, should be fitted an eccentric to work a plunger pump. There would be this double advantage. When the screw is disconnected, the ship going from four to six knots, the screw will generally revolve. Now, if the ship is disabled and so much water is made as to put the fires out, by disconnecting, the screw revolving as she goes through the water would pump the ship out; and that would apply to ships sailing as well as to ships in distress when the fires were put out by water in the hold. In the "Prince Consort" the screw would always move when disconnected, the ship going about five knots. Of course the immense power required to move a screw of those dimensions would have been abundantly enough to pump the ship out; therefore, if you were sailing, with the screw disconnected, the same action would take place. But supposing no such means were available, then I have calculated that the water admitted in twenty-four hours under ordinary sailing at sea would be no more than the quantity of water which it is usual to admit into a ship every day for the purpose of keeping the bilges clean, and which is pumped out by hand. In the "Prince Consort" we used to let in every morning—the engineer did it as a matter of cleanliness—a certain amount of water, which, running into the bilges, was pumped out again to sweeten the hold. The quantity of water that would be admitted into a ship according to my plan, merely for steering, would be no more than is let in every twenty-four hours for sweetening the bilges under ordinary circumstances. Of course the plan I propose is a fighting plan, which, with men-of-war now-a-days, is the constant condition in which they move. We found with a cruising squadron that very few ships could tack or do anything with the screw fixed, unless the wind was very strong.

Major **Baillie**, Bengal Staff Corps: I should like to ask some questions with respect to the pumping apparatus. Is there any provision for reciprocating motion?

Captain **Inglefield**: Yes; as an engineer would explain it, the ordinary poppet motion is used here (P, Fig. 1). It is well understood by engineers; though it is not shown in this drawing.

Major **Baillie**: May I ask the diameter of that piston?

Captain **Inglefield**: 36 inches. There happens to be a space which I measured in the hold of the "Achilles," just under the magazine, exactly fitted for the purpose. I thought this strong back (S, Fig. 2) might be in the way, but I found that the piston would drop exactly beside it. Over it is a valve (V, Figs. 1 and 2) which communicates with the Kingston valve through a slide. I know one objection may be raised as to foul water getting in, whether it would not interfere with the fine working of an hydraulic machine. But to get over that, a Kingston valve of the ordinary dimensions (about 12 inches), is used; but the aperture through which the water gets to it will be a double area, flush with the side of the ship; and that will have a coarse sieve fixed on it, so as to prevent seaweed and other things getting in. Here (V, Fig. 2) I propose another slide which will be capable of being taken off and cleaned when the ship is in port, so that it will be impossible for any dirt to get in. The water which passes into the tiller cylinder is a constant quantity, not a variable quantity, like that which is admitted for pumping purposes, and which afterwards passes into the bilge.

Major BAILLIE: I think you said the water, after it passes into the cylinder is discharged into the bilge. Can it be discharged anywhere else?

Captain INGLEFIELD: It must be discharged there.

Major BAILLIE: Is not the pump there higher than the sea outside?

Captain INGLEFIELD: No, it is inside.

Major BAILLIE: I am speaking of where the water acts upon the tiller.

Captain INGLEFIELD: There is no discharge there. I was just saying that that is constant water, only changed by the action of the pump here, A, Fig 1. The water that comes in with the power is changeable water; and after having exerted itself with its power it is useless, and falls into the bilge. The chief engineer of the "Achilles" suggested that it should be allowed to fall in here, F, Fig. 1, where it immediately gets into the bilges under the engine-room, and is taken out by the bilge-pumps.

The CHAIRMAN: The subject brought before us is one of very great interest in the present day. As far as I can see, it is a most useful and most desirable application. It appears to be perfectly safe from the shot of the enemy, and, from what I gather, it appears to be easily under control. On both these grounds it appears a very desirable application for our men-of-war. I think the meeting must congratulate Captain Inglefield on having shown so much engineering knowledge on this subject, and wish him all the success that he deserves. I am sure that you will join me in thanking him for his very interesting paper.

EXPANDING-SHOT-PLUG.

By Lieutenant ARTHUR H. GILMORE, R.N.*

IN submitting to your notice several of my inventions, I fear that instead of my finding safety in their numbers, you may find tediousness.

My excuse must, however, be that I think their adoption will be of benefit to the Service, and therefore to the country.

Inventing is not a lucrative business, as I know, to my cost; still the brain having brought forth an idea, we take it to our heart as the child of our mind's creation, and make much of it. Everybody thinks his own crow the blackest, and I suppose it is the same with inventors. At any rate, I think that no harm can accrue from trying these inventions of mine. It is a great boon to the Officers of both Services that we possess a place like this Institution, where we can come and disburden ourselves; in some cases, "a mouse may be the result of our labours;" but still here is an arena to which we can come, and having explained our plans, can listen to suggestions from, and enter into discussions with friends who have an equal share of zeal with ourselves for the good of the country.

I will first introduce to you my oldest friend, "An expanding-shot-plug." (Plate II, Figs. 1, 2, 3.) It is a friend of many years' standing, as I invented it when a midshipman in China. I have altered it since by giving it a sheath to protect it when being driven out through a jagged shot-hole in an iron ship.

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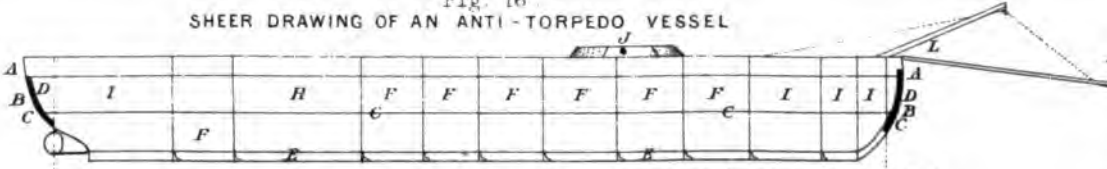
* Now Commander Gilmore, R.N.—ED.

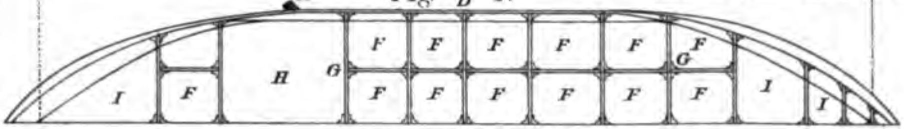
Fig. 16.

SHEER DRAWING OF AN ANTI-TORPEDO VESSEL



Scale 1/24 of an Inch to a Foot

Fig. 17



Half breadth of Plan.

Fig. 19

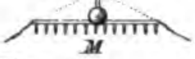
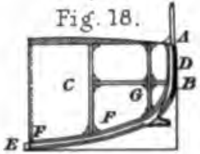


Fig. 18.



Scale 1/8 of an Inch to a Foot

SHOT-HOLE-STOPPER APPLIED FROM OUTSIDE AND VARIOUS FITTINGS.

Fig. 4. Fig. 6.

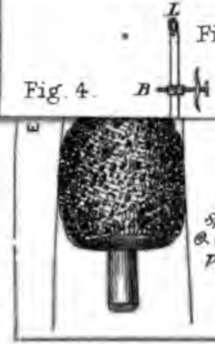
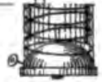
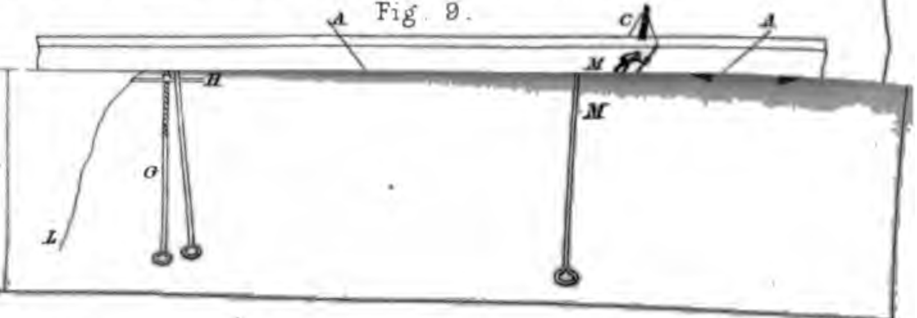


Fig. 8.



Spiral spring up to 40 lbs pressure & Gong which strikes when 40 lbs pressure is put on sponge

Fig. 9.



J. Jobbins

It is, in fact, an umbrella, except that the ribs radiate from the centre until they are at right angles with the rod; the shoulders surrounding the head of the plug prevent the arms going beyond the right angle. The covering and lining of the plug would be coated with oakum, and smothered with tallow and white-lead, in order to make them water-tight. The way to use the plug is this: force it through the shot-hole until the arms are clear of the outside, then slip the confining ring off, and bearing out on the thrusting rod, pull in on the handle, thus expanding the arms; you then turn away on the fly-nut of the screw, which, coming against the bar, which forms a bearing, the arms are hove taut against the ship's side, and the hole is stopped. I may here mention rather a curious coincidence, viz., that when I last lectured here, it was upon my "electric ship-steering-telegraph;" on that occasion Captain M'Killop gave an explanation of his plan for a portable "coffer dam" for stopping holes and leaks; this evening Captain Inglefield, whom I must look upon as a successful rival (for although my telegraph was adopted and several ships fitted with it, amongst others the Royal Yacht which brought the Princess of Wales over when she came to be married, still the instruments—why, I do not know—were considered too delicate); to-night Captain Inglefield lectures upon his invention for steering ships, a plan which has been adopted, and I explain my method of stopping holes, which I hope to see adopted. The expanding plug is for stopping *from the inside* any hole up to 3 feet in length by 2 feet 6 inches in breadth; you will see that the arms are of irregular lengths, so as to adapt the plug to the hole, putting the greater length of plug over the greatest diameter of hole.

I will now explain my method of stopping holes from *the outside.* (Plate II, Figs. 4—12). There is an old saying that the first blow is *half the battle.* Now, in case of a monster shot penetrating a ship below the water line, the first blow would be *all the battle,* unless we have the means (and we have not) of stopping that hole speedily and well. I feel convinced that this plug of mine will do it, whether the hole be between wind and water, or feet below the water line, for some of the new ships do roll pretty heavily. I have been asked the question, "How shall I find the hole if it is a long way down?" Well, if a ship rolls sufficiently deep to expose herself to penetration in the bottom, next time she rolls she will show us the hole, and we shall know where to apply the stopper; should she be obstinate, and refuse to roll to the same extent again, still, knowing by the concussion whereabouts the shot struck, we should feel about with an instrument called a groper, and hold on to the hole until we have the stoppper over it. At intervals along the side I have sockets fixed. (Fig. 9). The stopper consists, as you see, of a steel rod, having on it a travelling stud plate, with jamb-nut, and a top travelling plate with a screw working in a female screw in it, having on its inner end a plate to bear against the side. (Figs. 6, 9, 11, 12.) At the lower end of the rod is an oval plate (Fig. 7), concave in the centre, faced with gutta-percha; in the middle of this plate is a central pin, connected with the rod by what is called a Dutch joint. The mode of application is as follows:—Having taken the rod to the socket nearest the hole, it is lowered to the required depth, and kept in its place by guys worked from inboard, the stud revolving in the socket; the stopper being in its place, the screw is set to work and the hole is covered; if the hole is on the turn of, or under the bilge, the Dutch joint comes into play; as the screw is hove on, it pushes the rod outwards and downwards, the pin pressing the plate down, and you will see that as I heave, the plate turns in until the whole face has a bearing on the ship's side. (Fig. 9.) People say, "Oh, but whilst you are fixing this, the men applying it will be shot;" perhaps so, but war is not a game played with squirts and rose-water, it is a game in which men must expect killing, or being killed, to form part. I would protect the men by using mantelets, and hide them by burning a smoke-ball while they were at work.

Supposing the shot hole to be a very large one, with a crack radiating from it, I have a sort of spring mattrass, about 1 foot thick, with springs about it, and well-backed. That will be put inside this plug to cover the radiating crack.

EXPANDING SPONGE.

I will explain to non-professional people, that after a gun has been fired, particles of the cartridge are sometimes left in the gun in a state of ignition; if the gun is reloaded whilst these fragments are on fire, the charge will explode and kill the loaders. The use of the sponge [illegible] to extinguish these sparks. We all know that fire will die out unless [illegible] has its proper feed of oxygen procured from the air. By forcing the sponge home to the bottom of the bore, and pressing it there, the sparks will be extinguished. In my sponge you will see that the core is divided into three parts and hollowed into a wedge in the centre (Fig. 1[illegible] the three parts are kept together by elastic bands; the end of the staff forms the male wedge, and it is kept in its place by means of [illegible] pin working in a slot, the woollen covering is put on, and the sponge is complete.

The rod is kept in its place by a spiral spring working in the end of the female screw. As soon as the man has forced the sponge home, it expands and fills up the whole of the chamber. (Fig. 14). I have put out with it slow match, quick match, live coals, burning oakum, and all sorts of combustibles. The sponge expands about an inch and [illegible] quarter, and entirely fills up the end of the chamber of the gun.

You see that to force the sponge home, a certain amount of pressure is required. In order to know if the sponge is forced home, I have here for beginners, an instrument which I call a "Tell-tale." (Fig. 15). This spiral spring is equal to a pressure of 40 lbs. If you put that pressure on the sponge, the gong attached to it will strike; but unless the man puts 40 lbs. pressure upon the sponge, the gong will not strike. My new sponge is intended for men who have just joined the service, and are going through their instruction.

ANTI-TORPEDO VESSEL.

I have here what I call an anti-torpedo vessel. (Figs. 16, 17). It is supposed to lead the way for a fleet going in to attack a place. She is not impregnable or impenetrable; but she would receive a number of discharges from torpedoes before she would sink. She is intended for a forlorn hope, going in to clear the way before the storming party come on, and she would be manned by volunteers. She is built entirely in cells. Half these cells are to be used as coal-bunkers, magazines, water-tanks, &c. The other half I leave empty to give buoyancy. Here is the engine-room, with Admiral Elliot's turbine; there is, therefore, no screw to come to grief. We will say that this cell is the one under which a torpedo bursts. The torpedo blows it up, and sends it where you like. The cells round it are perfectly intact, and the water rises in it to the height of the water outside; the column of water not in the least depressing the ship. It would be like a screw well, with the water rising up and down in it. The ends before and abaft the cells are water-tight. (Figs. 16, 17). The forecastle would be divided into water-tight compartments. Such a vessel would require very few men, one gun's crew, one man to command, and one to steer. Captain Inglefield's steering apparatus would be a *sine quâ non.* You see that the cells come down, and are rivetted to the iron skin; and are again rivetted lower down to the bottom. (Fig. 16). Each cell forms a little ship in itself. Destroy one of these cells, and you have still other vessels. The drawing is on the scale of a gun-boat, 100 feet long, 25 feet beam. The ship contains twenty-eight of these cells besides the air-tight compartments. I thought of giving her a greater rise of floor, but I could not get stability. I gave her a flat floor, and large bilge-pieces (Fig. 18) to steady her. She is not intended for a sea-going ship. Her engines will only give her four or five knots in order to stem a strong tide. I purpose to carry one monster gun of 600 lbs. She is to be towed to the place to be attacked, and is intended to clear the way, the other vessels following in her wake. Very few provisions would be required, very little coal, and few stores.

DOUBLE-ACTION LOCK.

I have here also a double-action lock. Persons acquainted with gunnery know that two men, Nos. 1 and 2, attend the lock. When No. 1 has got his sight on, he has to wait for No. 2 to cock the lock. By means of my double-action lock, No. 1 has entire control of the gun himself. No. 1 slacks one end of the trigger line, which is an endless rope, and holds the other at the ready. As soon as the sight is on, he pulls it. He has not got to tell No. 2 to cock the lock, nor has he to wait for anybody. He has the gun entirely under his own control. For the ordinary tube will be substituted a tube with a top like the head of a large blanket-pin.

The CHAIRMAN: With reference to your external plug. I do not quite unde stand how you ascertain the position of a shot hole from outside the ship.

Lieutenant GILMORE: If the ship roll, and exposes a hole, she will show where th hole is. You take this rod to the nearest socket, lower it down until it comes on level with the shot-hole, it is kept in its place by guys. This rod is to be applie above the water-line on the flat of the ship. This curved rod is to be used belo the water line, and with this screw you jamb the plate over the hole.

Lieutenant LEGGE, R.N.: What would be the time for plugging a hole when lo down?

Lieutenant GILMORE: I should think three or four minutes. I forgot to tell yo that I have made the plate an oval (Fig. 7) for the same reason that I had this mad of an irregular form (Fig. 2). The longest part of the oval is to cover the large diameter of the shot-hole. There is a thumb-screw here, which jams this on a centr pin. I slacken it before I put it down to any angle you like, and it is fixed accordin to the length of the shot-hole.

Captain BOILEAU: What amount of lateral play does that admit of?

Lieutenant GILMORE: It will depend entirely upon the length of the rod. He is the radius; you can work it to any angle you like. As a rule, shot-holes are at a little underneath the water-line.

The CHAIRMAN: Have you sockets fitted on the ship's side?

Lieutenant GILMORE: These are fitted on the ship's side at intervals of about 3 feet. They would form part of the iron plate.

The CHAIRMAN: What is the weight of that stopper in an iron ship?

Lieutenant GILMORE: About 2¼ cwt. It looks very heavy on account of th thickness of gutta-percha. It is made with a flange edge, which on being press against the side expands.

Captain INGLEFIELD: The pressure of the external column of water would te to keep it in its place?

Lieutenant GILMORE: Yes. Having a large face to the stopper, you might mov it along without feeling for the shot-hole. The suction of the water would draw over the hole.

Lieutenant LEGGE: Is the spindle of that expansive apparatus made of iro because, supposing a shot should not strike straight, but should take an upwar direction, would it not be difficult to put that apparatus through the hole?

Lieutenant GILMORE: You could put this through.

Lieutenant LEGGE: What is the diameter of the spindle?

Lieutenant GILMORE: The spindle is seven-eighths of an inch.

Lieutenant LEGGE: If the shot should not take a direct course, you woul hardly get the spindle to bend sufficiently.

Lieutenant GILMORE: You can get it in at any angle, either straightforward o sideways.

Lieutenant LEGGE: I can well understand that you could, if the hole were straigh but supposing there were 18 inches of wood-backing and the shot, after it had go through the armour-plate, should rise?

Lieutenant GILMORE: I think if a shot penetrated the armour-plating it woul not be deflected by the wood-backing. There are many cases in an iron vessel wher you could not apply the internal shot-plug, and there I have the outward one t fall back upon.

Captain INGLEFIELD: I think the torpedo-vessel, to men who are likely to be put in the position of having to engage a battery on a foreign coast, is really a mos important invention; for I am quite satisfied, that in these days the thing mos likely to cause a panic amongst men, perhaps even amongst Officers, is the approaching a coast where torpedoes are supposed to lie. It is very well known that the action of a torpedo is such, that the instant a vessel touches it, almost at the same instant, she goes to the bottom. That is to say, a hole is made so completely through her, that the water rushes in, and there is small chance of any one escaping. That is the reason, I say, why the dread of torpedoes is likely to cause a panic amongst the men. I do think that a vessel such as has been proposed by Lieutenant Gilmore, is the best way of meeting that difficulty in approaching an enemy's coast; for that vessel manned by volunteers, taking the rough edge off all the torpedoes that lie in the route, will be safely followed by the rest of the squadron; and the oftener she was blown up, the more satisfied of their own safety would they be. I must congratulate Mr. Gilmore on developing this idea, because I feel if I were commanding a squadron and taking it in, that this vessel of Mr. Gilmore's would be the best safeguard that it could have in approaching a shore where torpedoes were supposed to exist.

Lieutenant GILMORE: I propose to have a chain attached to the vessel, which would drag after her and explode the torpedoes as she went.

Captain HORTON, R.N.: Would the vessel have substance sufficient to resist the explosion of any considerable torpedoes?

Lieutenant GILMORE: The less substance the better. If you had a rigid substance the explosion of the torpedo would drive up all the cells immediately around it; but by having thin iron plates the explosion finds vent at once, and comes up through the cells. If you had a thick 5-inch bottom, the effect would be to smash the whole.

Captain HORTON: But if a torpedo explodes over an area of 20 feet in diameter, which is not a large space, it would almost cover the beam of a vessel, 25 feet wide.

Lieutenant GILMORE: This design is merely drawn on the lines of a gun-boat. You might have the vessel any size you like.

Captain HORTON: My fear would be that with a vessel of such small dimensions, there would be great danger of her being cut in two by a torpedo.

Lieutenant GILMORE: If a torpedo burst, there would be a cushion of water between the torpedo and the vessel, which would tend to prevent any damage being done; whereas if the torpedo bursts immediately under the vessel, the action comes at once on the cells directly over the torpedo.

Captain HORTON: I forget the precise dimensions you gave.

Lieutenant GILMORE: This is the dimension of a 40-horse power gun-boat. The cells are 5 feet 8 inches by 4 feet 3 inches. Then, you have at the end these waterproof partitions.

Captain HORTON: I spoke because I happen to have seen a good many explosions with experimental torpedoes; and they have left me with the impression that the area of destruction was larger than you have stated.

Lieutenant GILMORE: I had the pleasure of going down with you on one occasion, and seeing Harvey's torpedo.

The CHAIRMAN: We are much obliged to Lieutenant Gilmore for having brought before us these novel inventions of his fertile genius, and we return him our best thanks for his explanations.

DESCRIPTION OF PLATE II.

FIGS. 1, 2, 3.—*Expanding-Shot-Plug, applied from inside.*—A. Shot-plug previous to expansion. B. Shot-plug expanded, external view. C. Shot-plug expanded, internal view. D. Shield to protect plug whilst being thrust out through jagged hole. E. Arms which spread the canvass and fearnought composing the stopper. F. Conical head of shot-plug. G. Rod of plug having a worm on it. H. Fly-nut screwing up against bearing-rod I, which goes across inside of shot-hole. K. Metal ring securing plug, until the arms are clear of shot-hole, when it is pulled off by jigging line L. M. Expanding rod with disc-end N, which, pressing against the inside of plug at F, opens the plug and keeps it expanded.

FIGS. 4, 5, 6, 7, 8, 11, and 12, *show Shot-hole Stopper applied from outside, and various fittings.*—A. Rods. B. Movable box and screw. C. Movable box and stud. D. Stopper plates faced with gutta-percha. E. Central pin. F. Dutch joint. G. Locking-nut, by slacking which the pitch of plate may be altered, as in H, so as to place greatest diameter of oval over greatest length of shot-hole. K. Loops for guys. L. Loops for lowering rod.

FIG. 8 shows the action of central pin and Dutch joint in turning the stopper in under bilge, the dotted line showing the perpendicular.

FIG. 9.—Section of ship's side, showing shot-hole B, with stopper being placed over it, and D stopped with internal stopper; AA, guys; C, capstan bar for derrick; SS, sockets; M, man ready to heave up screw.

FIG. 10.—Showing shot-hole covered by stopper, 8 feet below water-line, and on the turn of the bilge.

FIGS. 16, 17, 18, 19.—*Description of Anti-Torpedo Vessel.*—A. Upper deck. B. Water-line. C. Shows the division of the *alternate* cells into double water-tight compartments (empty). D. Armour plate from 2 feet below water-line to 8 feet above. E. Double bottom, divided into compartments of the same superficial area as the cells. F. Cells rivetted to inner skin. G. Junction of cells. H. Engine-room. I. Water-tight compartments. J. Turret. K. Nozzle from turbine. L. Derrick and groper. M. Groping rake and torpedo.

LECTURE.

Friday, January 15th, 1869.

MAJOR-GENERAL THE HON. JAMES LINDSAY, Inspector-General of Reserve Forces, in the Chair.

THE DISTRIBUTION OF OUR WAR FORCES. PART I.

By Captain J. C. R. COLOMB, Royal Marine Artillery.

THE distribution of our war forces covers such a vast extent of ground and involves so many questions of national importance, that I feel some explanation is due to this meeting for my apparent audacity in attempting to bring before it so large a subject. When it is remembered that the distribution of the Army is generally considered to be something entirely distinct from the distribution of the Navy, and *vice versâ*, and that both these questions have engaged and are absorbing the attention of eminent men, I feel that I may well be thought rash in attempting to deal with the two combined.

My reason for taking the Army and Navy together, under the head of War Forces, is simply that in the matter of distribution I am unable to see how it is possible to separate the one from the other. I am fully aware that this is not the common opinion, for, as a rule, it will be found that persons deeply interested in the warlike condition of this country may be divided into two classes—those who regard it from a purely naval point of view, and those who confine their attention exclusively to the military bearings of the question.

Theoretically, and by the thorough good feeling which exists between the sister services, they are the United Services, and practically they are united by the common purpose for which they exist, namely, national safety. Now let us take this common ground on which the services meet, and from this starting point investigate how far the national safety is dependent upon each, and in the first instance let us come to a clear understanding as to what is meant by the term, national safety. Unfortunately many persons seem to think that it means nothing more than the safety of that part of the Empire called the British Isles, and that national defence means the securing of Great Britain and Ireland against invasion. Now unquestionably the defence of the United Kingdom against invasion is an object of primary importance, but to suppose that this is the one thing needful in the matter of national defence, is a grievous error.

The sources of our greatness are the possession of India and our commercial prosperity—without India and without commerce we should be at the bottom of the scale of civilized nations. Bearing this in mind, let us suppose that the view which limits national defence to the protection of Great Britain and Ireland against invasion be practically adopted, and that the whole resources of the country have been wholly and exclusively directed to rendering the *soil* of the British Isles secure, and that this object has been fully attained, what would our position be in time of aggressive war on the part of one or more great powers? Does it not stand to reason that as the object of all aggressive war is either to acquire territory, or to weaken, if not destroy, the power of the nation against which war is made, the easiest and the safest mode is adopted to carry out that object; under the circumstances we have supposed, therefore, an enemy would naturally confine his efforts to destroying our commerce and our power in India, leaving the British Isles to watch this proceeding with impotent dismay.

The value of India to the Empire is something tangible, and the probable result of its loss to England is something easily understood by all, but our commercial prosperity is a vague term, and though it carries to the mind a conviction of stupendous wealth, the effects upon the country of its complete or partial interruption is not so easily calculated, and, therefore, we are but too apt to fall into a habit of generalizing upon this subject. Now for all practical purposes information must be definite and precise, consequently, I desire to draw your attention to a few facts relative to the value of our commerce in order to establish the necessity which exists for considering its protection as an integral part of national defence.

Our commercial prosperity is in direct proportion to the freedom with which we can carry on trade with our colonies and other countries. Commerce is in fact the link that binds together the several interests of the scattered territories composing the Empire.

If we take the trade returns for the year 1866, we find that the total imports into the United Kingdom amounted in value to £295,000,000 sterling, of which upwards of £72,000,000 came from our own possessions, and that the value of British produce alone, exported from the United Kingdom during that year, amounted in value to £188,000,000, of which more than £53,000,000 went to British possessions, the total value of exports from the United Kingdom (taking British and foreign produce together) came to £239,000,000, therefore the total value of articles *en route* to and from the United Kingdom during that year amounted to £534,000,000 sterling.

It is worthy of remark that our total annual exports and imports exceed in value those of Germany and France taken together, are greater than those of all Europe, exclusive of those two countries, and are nearly four times as great as those of the United States of America.

Now if we strike a monthly average of the value of our exports and

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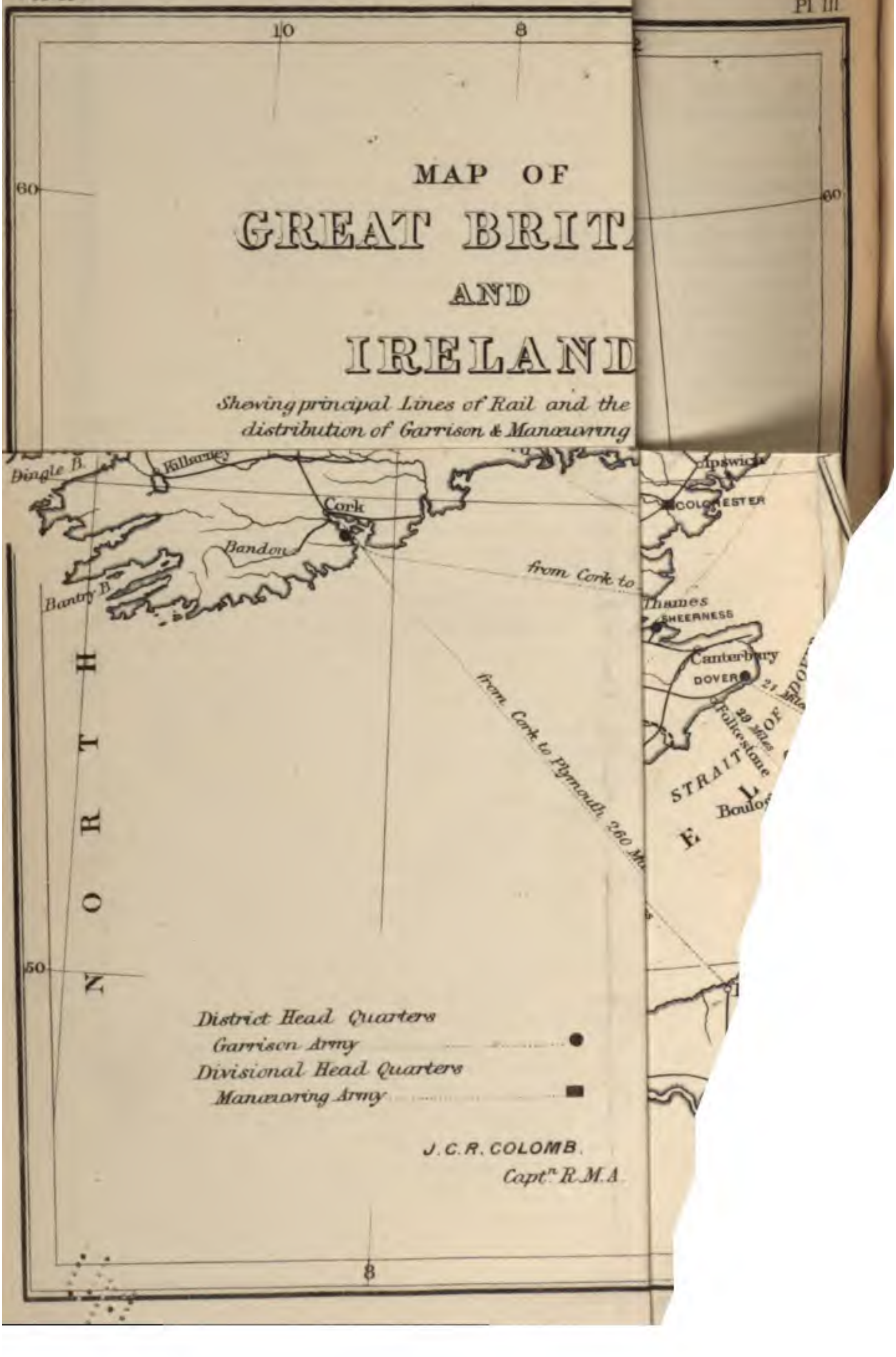

MAP OF
GREAT BRIT
AND
IRELAND
Shewing principal Lines of Rail and the
distribution of Garrison & Manœuvring

J.C.R. COLOMB.
Captⁿ R.M.A.

imports, we find it to be 44½ millions. Supposing, therefore, the trade of the United Kingdom to be completely interrupted, the loss on commerce may be estimated at the rate of 44½ millions per month. Under these circumstances, and with the above figures before us, the fallacy of supposing that national defence involves nothing more than the security of the United Kingdom *against invasion* is sufficiently evident. If the high roads of the world are closed to us by the presence of armed and opposing forces, against which we are unable to contend, the results would be almost, if not quite, as disastrous to the Empire as invasion itself. Hence it is that any scheme for national defence must provide for three things:—

1st. The defence of the United Kingdom.

2ndly. The protection of our commerce.

3rdly. The occupation of India.

It is upon the proper fulfilment of these three great requirements that our national safety will mainly depend, and it is for this we require war forces.

Now as regards the defences of the United Kingdom against invasion—it is to the Army and its Reserves that we must look for protection, but the Navy, represented by a Channel Fleet, is its powerful and necessary adjunct.

In the case of invasion, the Navy would be a mighty auxiliary to the Army, but the latter could afford no assistance, and would be but a host of spectators were our enemy's operations directed only against the Channel. Again, to protect our commerce, we require a Navy, but in order to enable the Fleets composing it to act, they must have fixed bases of operations, and these must be secured to them by land forces, consequently in the second requirement, the Army steps in as auxiliary to the Fleet.

Lastly, for the occupation of India, we require an Army; but the safety and efficiency of that Army depends upon our keeping open our communication with that country—this duty can only be performed by the Navy. These are briefly my reasons for asserting that the distribution of the Army and Navy are so intimately connected, that it is impossible to consider justly the distribution of one apart from that of the other.

Before passing to details, I would lay before you some general principles, which it appears to me desirable to establish.

As our war forces exist to meet the exigencies of war, they should be placed in such positions during peace, as would best enable them to act to the greatest advantage should that unhappy contingency arise.

Next, I think it may be fairly assumed, that in the matter of national defence, we are bound to look to the *general* welfare of the Empire. But when we remember the vast extent of our territories scattered as they are over the face of the globe, it is manifestly impossible to take the whole burden of their defence upon our own shoulders.

The question of defending the United Kingdom is of paramount importance, because it is the seat of Government, the base of operations, the citadel in fact of the whole Empire; but as regards our other territories—always excepting India—it is reasonable to say that those colonies and dependencies, whose geographical position and natural advantages do not entitle them to be considered as military positions necessary for the general safety of the Empire, must defend themselves. There are many places, which, for the sake of our communications we must strain every nerve to hold against all odds, and these I shall particularize hereafter, but to the rest of our possessions, we are compelled by our limited means to say, defend yourselves from direct attack, we can do no more than guard the communications which are common to us all. We should say this, because it is useless and wrong to hold out hopes of military assistance, which, in their hour of danger, we should have to withdraw, and it is evident, that if we can secure these high roads to ourselves, and consequently to them, they would, with the sole exception of our North American Provinces, now called "Canadia," be virtually excluded from the probability of attack.

When it is remembered that the area of the United Kingdom is one-thirtieth part of the total area of the British Empire; that its population is less than one-fifth of the total population of the Empire, and that the greater portion of our war forces is furnished by that small proportion of the population, it is plain that we must rigidly economise our forces by carefully choosing the best possible defensive positions for them, so as to command that which is essentially necessary to the military safety of the Empire, namely, "*its communications.*" We must, in short, by "strategy" make good the deficiency in respect of numerical military strength.

In speaking of Canadia I know I am treading upon delicate ground, because the possibility or advisability of its defence is a subject of much dispute amongst military men, but having particularly alluded to it, I will state my reasons for thinking it should be left to defend itself—they are these: In the first place we cannot keep open our communications with that country all the year round, because nature closes them.

2ndly. The war which would threaten our North American Provinces would of all others be the one which would most seriously endanger our communications generally. We should have enough upon our hands without undertaking the defence of an extensive frontier.

3rdly. Whilst recognizing the fact that "Canadia" possesses a reserve of militia and volunteers, numbering upwards of 200,000 men, we must not forget that any regular military force we could possibly dispatch to its assistance, though but a small contingent in respect of numbers as compared with this local reserve, would be large in comparison to the total strength of our regular army, if we exclude, as we must, the number required for India.

4thly. If we determine to engage in the task of defending "Canadia," the energies and resources required for that particular purpose would be just so much deducted from the means otherwise available for the general safety of the Empire. We must therefore call upon the rest of our dominions to make a sacrifice of a certain portion of their security;

we "rob a good many Peters to pay one Paul." If we succeeded in defending our North American Provinces, some of our other possessions would most probably suffer; if we failed in the attempt, "Canadia" would be no worse off than if it had not been made, but other of our territories would still lose by the transaction, and the whole Empire would feel the loss of prestige consequent upon failure.

Lastly. Whether we are able to defend "Canadia" is, to say the least, doubtful; that it is of no value as a military outpost is, however, certain; surely, therefore, to endeavour to hold, at considerable cost, a doubtful position of no value is false in principle.

These are some of my reasons for concluding that military expediency forbids the attempt. Under these circumstances, the removal of our regular forces from that part of our dominions follows as an inevitable necessity, for leaving them there now, amounts to "holding out hopes "of military assistance, which, in the hour of danger, we should be "compelled to withdraw." If we are not going to defend the Canadian frontier, there is another special reason for advocating the removal of the troops now quartered there. If, unhappily, a rupture with the United States were to occur at a certain time of year, we should be forced to leave them where they are; they would be cut off from us by weather, but, laying the physical difficulty aside, and supposing war to break out at a favourable period of the year, it would become a very serious question whether it would not be better to leave them where they were, rather than depress the public mind and insult "Canadia" by evacuating the country the moment any real danger appeared.

It may be argued that the presence of a regular force in that country is necessary for the repression of exceptional disturbances, such as the late "Fenian" outbreak; but I think it may be assumed that if the local forces are not equal to such a small emergency, it is useless to expect that they can meet the exigencies of more serious danger; in fact, the Fenian raids may be regarded as the means of giving the reserves of "Canadia" some experience in the art of war, and may therefore be of some advantage to those forces.

By all means, in peace and war, let us give to our North American provinces, and to all our other dominions, all the assistance we can in the shape of experienced officers and military equipment, but do not let us risk our regular forces in the direct defence of any portion of our territories, the possession of which is not essentially necessary to the safety of the state. Let us guard against the military blunder of leaving our communications and our whole position exposed, in order to defend comparatively small, and, in a purely military sense, valueless posts. Let "Canadia" and all our colonies and territories unnecessary to the Empire as military posts, fully and clearly understand that we will never suffer them to be wrested from the mother country, that any attempt to do so will bring down upon the aggressor the vengeance of England; but that they must rely on themselves for protection from direct assault, in order to leave the regular forces of the United Kingdom free to act in such a manner as will best make that vengeance felt.

I will now consider separately the distribution of our war forces for the performance of the three cardinal duties imposed upon them.

Direct assault upon Great Britain or Ireland may be placed und two heads:—

1st. Invasion, or the landing of a foreign army, with a view either t marching on the capital, overrunning the country, or taking ou arsenals and dockyards in reverse.

2nd. Attack upon one or more of those fixed and fortified arsenals a dockyards, either for the sole purpose of their destruction, in ord to cripple by a single blow the source of our naval strength, o with the intention of boldly seizing a strong position, turning th defences against us, and thus establishing a strong base f ulterior operations.

If the first plan be adopted, we know not at what points to expe attack; if the second is followed, we can pretty well guess them.

The first plan offers this great advantage to an enemy—more chan of taking the point of attack by surprise; therefore, it appears to m that the distribution of our force should have special reference t meeting this mode of attack, due precaution being taken at the sam time to provide for the other contingency.

If we would know the probable course of action which would b taken by an enemy following out the first plan, we find it concisel described in the report of the Defence Commissioners as follows:—

"The object of an enemy would be, in the first instance, to land
"sufficient force on some unprotected part of the coast, to enable
"to seize and hold a position under cover of which the invad
"army might be disembarked. With the power of concentration wh
"steam now affords, such a force might be assembled before dayl
"upon any point selected for the attempt, and thrown on shore in tw
"or three hours."

From this it is quite evident that the success of such an expedi would chiefly depend upon the amount of time allowed in the fi instance, for an unopposed landing. Time is what an enemy wo most require to make good a footing on British soil, therefore it is that we must most rigorously deny him. We can only do this taking advantage of the network of railroads and telegraphs, and tributing the forces with reference to them, so as to obtain the pow of concentration on any given point in the shortest possible space time.

To arrive at practical conclusions as to the precise nature of th distribution which will best fulfil these conditions, it is necessary t take into consideration three things:—

1. The ground to be defended.
2. The means of communication.
3. The circumstances by which the nature of the forces to be em- ployed may be determined.

Let us investigate these three things, in order to determine the nature of the distribution which would best meet the case of an enemy following out the programme placed under the second head.

1st. As to ground. The fixed and more or less fortified points of attack in Great Britain are, Woolwich, Chatham, Dover, Portsmouth, Portland, Plymouth, and Pembroke, and in Ireland, Cork. These are all included in the scheme drawn up by the "Defence Commissioners." I will suppose that the measures proposed for rendering complete the defensive works at each place have been carried out, consequently I take their estimate of the required strength of these garrisons at the time of expected attack (see Appendix, Table 1).

2nd. As to communications. Each one of these places possesses extraordinary advantages with respect to the power of rapid communication with the surrounding districts, and the interior. The most favoured are Woolwich, Chatham, Portsmouth, and Portland; the least, Plymouth.

3rd. The circumstances by which the nature of the force to be employed may be determined, are set forth in clause 9 of the Defence Commission Report, which runs as follows:—"The objects proposed to "be obtained by fortifying any place, are to enable a small body of "troops to resist a superior force which may attack it, or to enable "partially trained bodies of men to contend successfully with those "more perfectly trained and disciplined. There seems no reason to "doubt that such troops as may be got together from the disembodied "or less perfectly trained militia, with local or other volunteers, would, "with an admixture of regular soldiers, be able to defend our dock-"yards against very superior numbers."

From this it is clear that the garrisons of these positions may be chiefly furnished by our reserve forces. It may be argued that these are places of such vast importance to the country, that it would be injudicious to leave their defence chiefly in the hands of any but regular troops. It must, however, be remembered, that their defence is but a part of the general subject—defence against invasion—and it will be seen later that we require our regular forces elsewhere. Further, let the words of the Duke of Wellington be called to mind when he says—"I shall be deemed foolhardy in engaging for the defence of the Empire "with an Army composed of such a force of militia. I may be so. I "confess it. I should infinitely prefer, and should feel more confidence "in, an Army of regular troops, but I know that I shall not have them. "I may have the others."

Having fixed the nature of the forces to be principally employed in the defence of our fortified positions, the next thing to be done is to "get them together."

Now, disembodied Militia and Volunteers save us the trouble of distributing them, for they distribute themselves, consequently for all practical purposes we must take them as we find them, and our efforts must be directed to bringing them together *at the right time*, and at *the points where they would be required to act.* It need not be asked what is the right time? for the Duke of Wellington fixed it at "the moment war is declared." So far then, we know the nature of the force, we know the points, and we know the time. But here it may be asked, what proportion of regular troops is required? How is the "admixture" to be estimated. I think we may conclude that the necessary number of regular troops may be taken at less than half the total garrisons. Indeed, when it is borne in mind that we are now considering *only* direct assault upon these fortresses, which really means bombardment from the sea, or attack upon the sea defences, we may fairly conclude that *one-third* regular troops would be sufficient, provided more are within reach to re-inforce the garrisons in case of necessity. Assuming this to be a correct proportion, I will now take the counties surrounding these places in England, and show how far they are capable of meeting the demand upon their reserve forces for two-thirds of the garrisons.

Table 2 is a rough statement of the reserves at and about these fortified points, and I think it will be found sufficiently accurate, although I have been unable to obtain official returns.

It will be seen by this that Cornwall and Devon, taken together, can easily supply two-thirds of the war garrison of Plymouth. Dorset can provide in like manner for Portland. Wilts, Sussex, and Hants, very nearly make up the number required for Portsmouth, and Kent and Surrey can supply Woolwich, Dover, and Chatham.

Thus the south of England would be divided into districts.

The Plymouth district consisting of Cornwall and Devon.

The Portland district consisting of Dorset.

The Portsmouth district consisting of Hants, Wilts, and Sussex.

The Dover and Chatham district, of Kent and Surrey.

Now, if it be a true principle, and I maintain that it is, that "troops "should be placed in such positions during peace as would best enable "them to act to the greatest advantage on the breaking out of war," it is pretty clear that expediency points to the advisability of training the reserve forces of Cornwall and Devon for the special purpose of defending Plymouth, those of Dorset for Portland, and so on. The annual training of the Militia, the annual reviews and gatherings of the Volunteers of the counties I have named, would then take place on the ground they would in reality be called on to defend. This is the broad principle I venture to advocate. Each annual training would then be a real preparation for war, Officers and men would learn their duties and their places, and each would regard the fortified point of the district to which he belonged, as his post of honour and his military home. The fortifications provide incidentally spare barrack accommodation. The Militia require barracks in which to train their men. Let the southern counties thus have the barracks they would occupy in war.

As regards the admixture of regular troops for these garrisons, it is essential that the whole, or at least the greater proportion, should consist of artillery; but as our regular forces are required for the general service of the Empire, it is necessary to consider the whole question of its defence before proceeding to details as to numbers.

It will be observed that I have omitted to mention the Channel Islands, which, to borrow the late Sir William Napier's words, "are "more intimately connected with the defence of England than is "generally supposed." Our position there properly comes under the head of "fixed points," and although it is an outpost, I will say a few words respecting it before passing to the rest of my subject. My best plan is to summarize the late Sir W. Napier's opinion, which amounts to this, "Jersey and Guernsey must fall to France whenever she

" chooses to annex them." Alderney must and can be held by us with 1,000 regular troops and the island militia.*

Now take the case of an enemy following out the plan of operations placed under the first head.

We do not know the exact points of attack, but there are probabilities which help us to arrive at general conclusions, bearing on the question of the distribution best calculated to meet the emergency. To these I will briefly allude. First of all from what quarter is an attack of this nature to be expected? Not from Russia alone with her ports closed for a great portion of the year by ice; nor from Prussia, for the same reason; the other powers to the westward of these two need not be considered until we come to France.

Well, then, if unhappily France be the aggressor, and wants to march on the capital, over-run the country, or take a fortified position in reverse, where is it probable she will attempt to land her army? We can only answer we don't exactly know, but we *do* know that the south is more open to attack than the north. If the object be a march on London, it is not likely any point of the coast at a great distance from London would be chosen for the landing of the main body, as the difficulty of keeping open the line of communications in the rear of the advancing army would increase with its length. Hence in this instance the south or part of the east coast would most likely be threatened. If the object be to over-run the country with perhaps the ulterior motive of concentration, we may look for assault at several different places; if the intention be to take one of our fortified points in reverse, we may expect the landing to be attempted somewhere in the vicinity of one of those points. Pages—I might say—volumes, have been written in the endeavour to determine the probable point of attack, and the only safe conclusion that can be drawn from the mass of evidence and opinions is a very general one. I think it is briefly this, that, owing to a variety of circumstances, the points most likely to be selected are situated on that part of the coast lying between the Humber and Penzance. This line, as the Royal Commissioners tell us, is " 750 miles long, and there is an aggregate of nearly 300 miles on " which a landing may be effected." The practical lesson to be learnt from this general conclusion may be thus summed up: the forces intended to meet the case of an enemy acting on the first plan of operations, must be distributed in such a manner as will best secure the power of rapid concentration of large bodies of troops on or near any given portion of this assailable coast line; this would also be consistent with the duty of keeping open the communications of our fortified positions with the interior. I must here explain that by " concentration of large bodies of troops" I do *not* mean the assembly of a variety of small and fragmentary portions of regiments or even brigades, and so collecting a force equal to an Army *only* in number, but I intend to convey the idea of mobilized and complete brigades, or divisions of an Army converging with rapidity and precision on any named point.

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* See Appendix to the Life of General Sir W. Napier.

To avoid confusion I will here adopt the term used by the "Defence Commission," and call the force intended for the defence of the coast line "*The Manœuvring Army*," in contra-distinction to the force required for the defence of the fortresses, which may be termed the "*Garrison Army*." The more important consideration relative to the distribution of this Manœuvring Army, is that which has reference to communications, for the defensive force is comparatively small, while the line of defence is of great extent. It is unnecessary to consider the circumstances which determine the nature of the force to be employed, for there is no choice, nor possibility of selection. The Manœuvring Army consists of the balance remaining of the military forces in Great Britain after deducting those required for the "Garrison Army." The more regular troops the better, but for obvious reasons the bulk of this manœuvring force must be composed of regular and irregular reserves —militia and volunteers—and as I before remarked these forces distribute themselves. What we have to do, therefore, is to devise means by which the forces scattered over the face of Great Britain can be most readily brought to bear in organized masses upon any point on the coast lying between Penzance and the Humber.

This can best be done by grouping the counties into districts, organizing the reserve forces of these districts into complete brigades, assigning to each brigade so formed, an appointed place in a division, and allotting to each division such position in the "Manœuvring Army" as is most convenient and suitable to the general object intended to be accomplished by the "Manœuvring Army," namely, the defence of the coast.

As an illustration of this principle I have prepared Tables 3 and 4. It is imperfect and open to many grave objections as regards details, but I trust the largeness of the question may be allowed to plead my excuse for its defects. In drawing it up I have been guided by considerations of a general kind, and a brief allusion to these will be the best explanation of the tables.

In arranging the counties, I have endeavoured to secure a convenient number of men to each district, so as to admit of a "brigade-organization." I have not, however, attempted to subdivide London, Lancaster, or Stafford into districts, as that would more properly come under the head of "organization." In fixing the district head-quarters, my object has been to obtain a central position, where the railways opening up the district, meet, at the same time looking to the means of direct communication with the head-quarters of the "division" to which the district belongs; and I have given the preference, where it was possible, to county towns. It seemed to me desirable that the grouping of the forces of the various districts into "divisions" should be made dependent upon two things, namely, convenience of numerical strength, and the facilities afforded by the existing lines of rail for intercommunication. In determining the situation of its head-quarters, I have considered the probable destination of the "division" after being called out and concentrated at its head-quarters for actual service. Now this distribution is framed in order to secure the rapid concentration of organized masses upon any portion of the more assailable coast line. Let us see how it would answer the purpose. Supposing danger imminent, the first step to be taken is the gathering in of the forces at their district head-quarters; the next, the moving of the brigades from those points to the head-quarters of the "division." This would occupy a few hours. The position of the Manœuvring Army would then be as follows:—The 1st "division" at Aldershot; 2nd, Colchester; 3rd, Bristol; 4th, Oxford; 5th, Stafford; 6th, Lincoln; 7th, Manchester; 8th, York; 9th, Newcastle.

A reference to the map will show that these points are all, in a greater or less degree, centres of our railway systems. Aldershot, for example, commands the whole coast of Kent, Sussex, and Hants; Colchester is on the line of rail running along the coast of Essex, Suffolk, and Norfolk; Bristol is within easy reach of the coast of Dorset, Devon, and even Cornwall; the town of Lincoln is about equi-distant from any point of the coast of that shire.

That the south of England is more open to attack than the north, east, or west, needs no proof—it is evident to all; therefore, the principles of distribution of the forces for the protection of England should be consistent with the knowledge of this fact, consequently what we have to provide for is a general movement towards the south of all our forces on the eve of their being called on to act. Supposing the proposed distribution to be adopted, would it meet this requirement?

To find an answer to this question let us imagine that an attack is expected. The concentration of the "divisions" would have taken place "at the moment war was declared." Our next duty would be to guard against surprise, but it is impossible under the present political division of Europe for any portion of the east coast to be *absolutely* surprised, for no considerable force could pass Dover day or night without its being known a few minutes later, all over England. This limits the possibility of surprise, under existing circumstances, to an attack somewhere between Dover and Penzance. Under these circumstances, the first "division" would probably be moved from Aldershot to Tunbridge, the 3rd from Bristol to Exeter, the 4th from Oxford to Salisbury, the 5th from Stafford to Bristol, the 7th from Manchester to Aldershot, the 8th from York to Oxford, the 9th from Newcastle to Stafford, the southern Scotch reserves moving down and taking up the positions vacated in succession by the English "divisions," being thus ready to move rapidly to the support of the more advanced forces.

In less than 48 hours from the declaration of war, this might be the position of the "Manœuvring Army," and once in this position it seems to me impossible for a landing of any serious nature to take place without at once encountering the concentrated opposition of previously organized masses.

It is needless to point out the variety of combinations that could be made with a manœuvring army so situated. I confine myself to an illustration of the one which would most probably be required.

In the matter of the defence of Great Britain, I have taken the question of reserve forces first, for three reasons. 1st. Because the number of regular troops likely to be available for that duty would be small compared with the strength of our reserves, therefore it is upon our reserves we must mainly rely. 2ndly. Because the more the military position of the reserve is improved, the more are our regulars left free to act for the general welfare of the whole Empire. 3rdly. Because more is to be done by example than precept, and consequently if the colonies see that the mother country has to look to reserve and irregular forces for self-defence, there is the more hope of their doing the same.

We now come to Ireland. Here the limited nature of the reserve forces and other circumstances render it necessary that the defence of this portion of the United Kingdom should be provided for independently of local resources. When treating of the defence of Ireland therefore, it is necessary to reverse part of what I have just said, hence the question of reserve forces must be taken last, and their arrangement must conform to that of the regular troops. It is impossible to enter fully into this subject at present, and I only propose to bring forward a few general principles. The duty of preserving internal order unfortunately influences the peace distribution, and this involves many and minor details of a nature altogether outside the object of this paper.

A large number of regular troops would be required, and larger re-inforcements must be at hand, at the "moment of expected attack." It is likely that an enemy whose real object was invasion of Great Britain, would try to create a diversion by attempting to throw a force detached from the main body upon the Irish coast; on the other hand Ireland might be the sole object of attack. The extent of this danger, however, is considerably modified by the difficulties attaching to great expeditions against a country separated by long distances from the base of offensive operations. In any case the south coast is most exposed. The fortified point is Cork harbour, and for its defensive works 2,500 men are required. The Duke of Wellington fixed 10,000 men as the number that should be at Cork at the moment war is declared. Now, as the principal portion of the force for the defence of Ireland is not local, its reinforcements must be drawn from Great Britain. The forces in Ireland may properly be regarded as the right wing of the Manœuvring Army of the United Kingdom, separated from the left by St. George's Channel, and at the moment of expected attack the left wing is liable to be more seriously threatened than the right. If the right requires reinforcements, they must come from the rear of the left, and, in short, the common reserves for both wings are composed of the force in Scotland. The most convenient points of entry for columns moving to the support of Ireland are Belfast and Dublin; the latter is the centre of the Irish railway system, but the former has the advantage of being the nearest to the reserves. As in England, so in Ireland, when danger threatens, we must be prepared for a general and rapid movement towards the South.

The same broad principle of massing troops and all available reserves at the centre of the railway systems commanding the assailable coast, may be applied to the forces in Ireland in much the same manner as to those in Great Britain, no matter what may be the nature of the peace distributions forced upon us by circumstances beyond control, and peculiar to that part of the United Kingdom. And as it appears that the arrangement of the reserve forces, which are only required in actual war, should conform to those of the regular forces, the head-quarters of the districts should be fixed at the centre of the railway systems. These are Dublin, Belfast, Cork, Limerick, the Curragh, Kilkenny, Athlone, Mullingar, and Inniskillen. Now, Cork being a point, the safety of which is of vital importance, its defence could not be more fitly and appropriately provided for than by leaving its protection in the hands of that tried and representative force of the country, the "Royal Irish Constabulary." The interior economy of that body better adapts it to purposes of local defence than to form an integral portion of the Manœuvring Army. Thus the regular troops might be left free to act for the general defence of Ireland. Table 5 will better explain these general ideas.

Questions relating to the defence of Ireland are interwoven with difficulties requiring time to enter upon, as may be gathered from a paragraph in one of the late Sir W. Napier's letters to General Shaw Kennedy, when, in speaking of the various places open to the attack of a hostile force, he says, "They, *i.e.*, the enemy, might go to Milford "Haven, but that would not be very important. If they went to "Ireland, I know not what to say or do."*

Next, as regards Scotland. Owing to its position, invasion or a land attack there, is in the last degree improbable. But nevertheless, that part of Great Britain would have to play a most important part in the defence of the United Kingdom. It would furnish the reserves for both England and Ireland. The peculiarities of the national character, the steady northern blood in fact, would give a power and character to the reserves, not to be estimated or measured by mere numerical strength. The same principles of distribution apply in this case, and the main object to be obtained is the power of dispatching organized columns of support to either or both wings of the "Manœuvring Army," with ease and rapidity. In this view I have sketched out the distribution in Table 6.

Such a distribution would admit of a complete and compact organization, give to each district its brigade staff responsible to the Officer commanding the "division," who, with his regular and reserve staff, should be the real head of the regular troops and reserve forces in the counties forming the "division" under his command. The outline is then complete.

Here for the present I leave that part of the subject relating to the defence of the United Kingdom, returning to it when the number of regular forces likely to be available for this duty can be fairly estimated, which cannot be done until the occupation of India and the protection of our commerce have been considered.

There is no necessity for any detailed statement respecting the British forces required for the occupation of India. We know that it must be held in peace as in war by military force. While we are on good terms with other great powers, a regular force must be maintained in that country sufficient to preserve internal order and equal to any sudden local emergency which might probably arise. But in case our position should be reversed, we must be prepared to augment that force, and so render it capable of withstanding external pressure. Under such circumstances the mere fact of the presence of sufficient force in our Indian possessions will avail but little if we do not hold with a strong hand those intermediate positions between this country and those territories with a view to keeping open our communications, and making those halting-places secure which form the connecting links between the Army in India and its reserve in the United Kingdom. These are Gibraltar, Malta, and Aden. I will not here speak of those points on the Cape route, for their importance as military posts has more direct reference to the protection of our commerce. The peace garrisons of the places I have named require about 10,000 men.

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* Vide Life of Sir W. Napier, page 331.

The present British force in India may fairly be taken as an estimate of the number of regular troops required for that service for many years to come. In round numbers it is 64,000 men.* Now if this be the number necessary for the preservation of internal order and for meeting sudden contingencies, we may reasonably conclude that a very considerable increase would be required in the event of the frontier being threatened. The actual danger arising from such a circumstance is not to be weighed by the amount of force which could be brought to bear on the frontier, but by the effects it would produce upon the mind of the Indian people. "The power of Russia for mischief arises "not so much from the force she can muster, as from the insurrection "which her advance may create."† If the reinforcement would be required on the breaking out of war, it should be ready at hand during peace, and it is most desirable it should occupy such a position as would enable it to move to India in the shortest possible space of time.

If it be necessary, and most undoubtedly it is, to maintain in India a British force of upwards of 60,000 men, it should not be the *whole* British force.

India is England's most important possession, but it is contrary to all principle to suppose that even the greater part of the total available force should be pushed forward to hold a distant, difficult, and extensive territory. What would become of an Army so distributed? From whence are reserves and reliefs to be drawn in such a case? Is it possible to conceive the Imperial Army required for India being treated as a movable column without an imperial base, left to sink or swim as it best can?

Again, should India require reinforcements in consequence of any demonstrations on the part of Russia, it might be necessary at the same time to place the garrisons of Malta and Gibraltar on a war footing. Not only, therefore, must reserves be at hand for service in India, b we must be equally prepared to largely reinforce those garrisons. W should in that case require for duty in or on the road to India more than 100,000 men.

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* The exact number in Estimates for 1868-9, is 64,466.

† Vide *Times*, 9th December, 1868.

The United Kingdom being the head-quarters of that Empire of which India is a part, is the most fit and proper position for the reserves for Gibraltar, Malta, and India to occupy. It is the only place where they can be ready at hand to move into their positions in the shortest possible space of time; and defending Great Britain and Ireland is a duty entirely consistent with that of supporting the Army in India.

Our regular British Army consists of about 200,000; deducting the number required for Malta, Gibraltar, and India during peace, we have 126,000, but it cannot be said that any large portion of this force is available for any duty which would prevent its being immediately ready for service at those places, such as colonial service. Were we suddenly engaged in a war which simultaneously threatened India, Malta, Gibraltar, and the United Kingdom itself, as might happen in the case of a combination between Russia and France, the force left at home after the despatch of the necessary reinforcements would certainly be less than half our total Army. If then any considerable portion of this 126,000 is not forthcoming, what would become of India and the road to India on the breaking out of such a war; what consolation would be afforded by remembering that we have troops in our colonies, everywhere in fact but where they are wanted?

If France alone were to declare war against us we should have to fill up our Mediterranean garrisons; this would leave something less than 100,000 available for the defence of the United Kingdom. Of this number 77,000 only would form part of the Manœuvring Army, for 22,000, the one-third of the total garrisons of the fixed points, and 1,000 for Alderney, must be deducted, more than half this, 77,000, would probably be required in Ireland, so that, if in time of peace we have 126,000 regular troops in the United Kingdom, we can only calculate on the services of some 30,000 or 40,000 for the defence of the English coast line at the moment of expected attack.

In my next paper I hope to show that this distribution, limiting as it does the foreign service during peace of our regular Army to India, Aden, Malta, and Gibraltar, is the one best adapted to meeting the other great requirement—the protection of our commerce.

Now supposing this distribution to be carried out; supposing the organization and equipment of the forces to be perfect, supposing Gibraltar, Malta, and Aden to be impregnable, India and the United Kingdom to be secure, it would all go for nothing, it would be all useless—nay, worse than useless—when put to the crucial test of war, unless we command the communications between each and every one of those places.

A more powerful fleet than our own in the Channel, a more powerful fleet than our own in the Mediterranean, would convert the whole fabric of our military strength into a simple "lock up" and "lock out" of our military force.

TABLE 6.

SCOTLAND.

Distribution of Reserve Forces.

District Head Quarters.	Counties composing Districts.	Militia.	Volunteers.	Total Strength of District.	Divisional Head Quarters and Strength.
Dumfries..	Kircudbright ..	.. ..	500	2,154	1st Glasgow
	Wigton ..	.. ..	400		
	Dumfries ..	654	600		
Paisley ..	Ayr	841	1,500	5,301	
	Renfrew ..	560	2,400		
Glasgow ..	Lanark ..	1,911	8,100	11,311	
	Dumbarton ..	.. ..	1,300		
					18,766
Stirling ..	Stirling ..	599	1,000	2,099	2nd Edinburgh
	Clackmannan ..	.. ..	500		
Peebles ..	Peebles ..	.. ..	200	1,400	
	Selkirk ..	.. ..	200		
	Roxburgh ..	.. ..	400		
	Berwick ..	.. ..	600		
Edinburgh	Edinburgh ..	878	4,800	7,093	
	Haddington ..	415	500		
	Linlithgow ..	.. ..	500		
Perth ..	Perth	495	1,200	4,237	
	Fife	542	1,900		
	Kinross ..	.. ..	100		
Forfar ..	Forfar	.. ..	2,700	4,276	
	Kincardine ..	776	800		
					19,105
Aberdeen..	Aberdeen ..	741	3,200	3,941	3rd Aberdeen
Elgin ..	Elgin	.. ..	900	1,600	
	Nairn	.. ..	100		
	Banff	.. ..	600		
Inverness	Inverness ..	692	1,300	3,507	
	Ross and Cromarty	515	1,000		
					9,048
Without Rail communication.					46,919
	Argyle Bute	381	1,500		
	Sutherland ..	.. ..	400		
	Caithness ..	.. ..	1,000		
	Orkney and Shetland	.. ..	500		

LECTURE.

Friday, January 29th, 1869.

CAPTAIN EDMUND PACKE in the Chair.

THE DISTRIBUTION OF OUR WAR FORCES. PART II.

By Captain J. C. R. COLOMB, Royal Marine Artillery.

WHEN last I had the honour of addressing a meeting here, I endeavoured to establish the necessity, which to my mind exists, for considering National Defence as involving three great requirements, namely:—

The defence of the United Kingdom.
The occupation of India.
The protection of our commerce.

I then attempted to explain the outline of a distribution to meet the first two of these; but, it was necessarily incomplete, owing to the fact that these three things are so intimately connected, that any one of them cannot properly be considered wholly by itself.

I will now briefly bring before you some general principles relative to the distribution of the forces for "the protection of our commerce."

I trust I may be excused, if I repeat this afternoon a good deal of what I put forward in a pamphlet some two years ago.*

The protection of our commerce means in reality the securing of the Imperial communications commercial and military. I stated in my last paper that it would be useless to distribute forces for the defence of the United Kingdom, and the occupation of India, unless we at the same time provide for the safety of the routes between those places; and I would now remind you that, the communications of the Empire being the common property of all its component parts, it follows that their security is an Imperial necessity, and that our first duty towards our colonies and possessions is to provide the means by which the roads between us and them may be kept open. In time of peace this means nothing, in time of maritime war it would be a most difficult operation, and upon its successful accomplishment will depend not only their safety, but our own. The general principle of placing our forces in

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* Protection of our Commerce: 1867.

TABLE 6.

SCOTLAND.

Distribution of Reserve Forces.

District Head Quarters.	Counties composing Districts.	Militia.	Volunteers.	Total Strength of District.	Divisional Head Quarters and Strength.
Dumfries..	Kircudbright ..	.. ..	500	2,154	1st Glasgow
	Wigton ..	.. ..	400		
	Dumfries ..	654	600		
Paisley ..	Ayr	841	1,500	5,301	
	Renfrew ..	560	2,400		
Glasgow ..	Lanark ..	1,911	8,100	11,311	
	Dumbarton ..	.. ..	1,300		
					18,766
Stirling ..	Stirling ..	599	1,000	2,099	2nd Edinburgh
	Clackmannan ..	.. ..	500		
Peebles ..	Peebles ..	.. ..	200	1,400	
	Selkirk ..	.. ..	200		
	Roxburgh ..	.. ..	400		
	Berwick ..	.. ..	600		
Edinburgh	Edinburgh ..	878	4,800	7,093	
	Haddington ..	415	500		
	Linlithgow ..	.. ..	500		
Perth ..	Perth	495	1,200	4,237	
	Fife	542	1,900		
	Kinross ..	.. ..	100		
Forfar ..	Forfar	.. ..	2,700	4,276	
	Kincardine ..	776	800		
					19,105
Aberdeen..	Aberdeen ..	741	3,200	3,941	3rd Aberdeen
Elgin ..	Elgin	.. ..	900	1,600	
	Nairn	.. ..	100		
	Banff	.. ..	600		
Inverness	Inverness ..	692	1,300	3,507	
	Ross and Cromarty	515	1,000		
					9,048
Without Rail communication.					
	Argyle Bute	381	1,500		
	Sutherland ..	.. ..	400		
	Caithness ..	.. ..	1,000		
	Orkney and Shetland	.. ..	500		
					46,919

LECTURE.

Friday, January 29th, 1869.

Captain EDMUND PACKE in the Chair.

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* Protection of our Commerce: 1867.

The distribution of the Navy embraces three questions relating respectively to ships, men and naval arsenals or head-quarters. Without entering into any discussion on the subject of naval architecture, I think I am safe in asserting that the nature of the ships to be employed, may be broadly divided into three classes:

1st. Those that are intended to take part in the combined action of a fleet.

2ndly. Cruisers.

3rdly. Port-defence vessels, floating batteries with motive power.

The disposition of these classes must depend upon the nature of the service to be performed. For instance, in the Channel and Mediterranean, we require the first description of ship, because combined action on the part of opposing forces, is what we have to expect: on more distant seas, danger would threaten our commerce and communications in the form of swift cruisers acting more or less independently, therefore to guard against their depredations, we must employ a similar class of ship. Port-defence-vessels are necessary to secure the majority of naval arsenals or depôts from bombardment from the sea, for this is a contingency for which, generally speaking, fortifications and land forces are no real provision. To leave the defence of the arsenals in the hands of the sea-going fleet, is to tie them up so far as other duties are concerned; and further, it would be in effect "to use the fleet to maintain the arsenals, instead of the arsenals to maintain the fleet." As regards men, the numerical limits are defined by the number and nature of the ships composing the fleet; and the resources of the naval arsenals must be proportioned to the requirements of the fleets of which they are the base.

Now if the fleets are to be distributed according to the interests they are to protect; it is necessary in the first place to ascertain the distribution of commerce. I would therefore refer you to table A, in the Appendix, which gives sufficiently accurate information to answer our purpose. The next table, B, shows our commerce during the year 1867, arranged into districts, by which will be seen the "precedence," as it were, of oceans, seas, and certain portions of the Atlantic, determined by the total approximate value of articles "*en route*" to and from the United Kingdom during that year. It is as follows:—

Channel { 1. Waters of the United Kingdom.
Channel { 2. North East Atlantic.
3. South Atlantic.
4. North West Atlantic.
5. Indian Ocean.
6. German Ocean.
7. Mediterranean.
8. Baltic.
9. Pacific.

Of these, the waters surrounding the United Kingdom, the greater portion of the Atlantic Ocean, the German Ocean, the Mediterranean, and the Baltic do not in time of peace require the presence of any force for the protection of trade. Next in importance is the South Atlantic. In time of peace a large force is not required in the interests of trade,—the number of trading ports *not* in the possession of civilized powers being comparatively small—not more than about £2,500,000 worth goes to or comes from such places in that ocean. The same may be said of the North West Atlantic. The Indian Ocean is next on the list, and here the presence of a tolerably large naval force is at all times essential to the welfare of our trading operations. Lastly, I would observe that in the Pacific a small force may be employed with advantage to our mercantile interests even during a period of profound peace.

The actual strength and composition of each fleet must ever be determined by the forces against which it may probably have to contend, and as it is only of the peace-distribution I am now speaking, these opposing forces are either semi-civilized or barbarous.

War with an *European* maritime power would directly threaten the most valuable portion of our mercantile field of operation, but so long as we command the Channel and Mediterranean, these powers are held in check; they are, as regards the rest of the world, more or less "blockaded." Under these circumstances it would not be necessary to increase to any great extent the number of our cruisers in the more distant parts of the globe. The constitution of European navies confirms this view, for as a rule the ships composing those fleets are better adapted to taking part in combined action than to cruising purposes.

But when we turn to the *United States* the whole aspect of the question is completely changed. Attack from this quarter on the Channel or Mediterranean is, to say the least, most improbable, nor is any serious demonstration likely against the northern part of the east Atlantic.[*] The north-west Atlantic is more directly exposed, but our commercial interests in that portion of the globe during such a war would be comparatively small. If we look at the composition of the American navy, and consider its past history, we find that it may be divided into two classes, one suitable to the purposes of defensive operations near its own ports, the other designed for the special and particular object of carrying on offensive and predatory warfare on seas far removed from its home; we may consequently, I think, conclude that the South Atlantic, the Indian Ocean, and the Pacific would be the principal scenes of action.

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[*] See Report of the Chief Constructor, U.S. Navy, 1864.

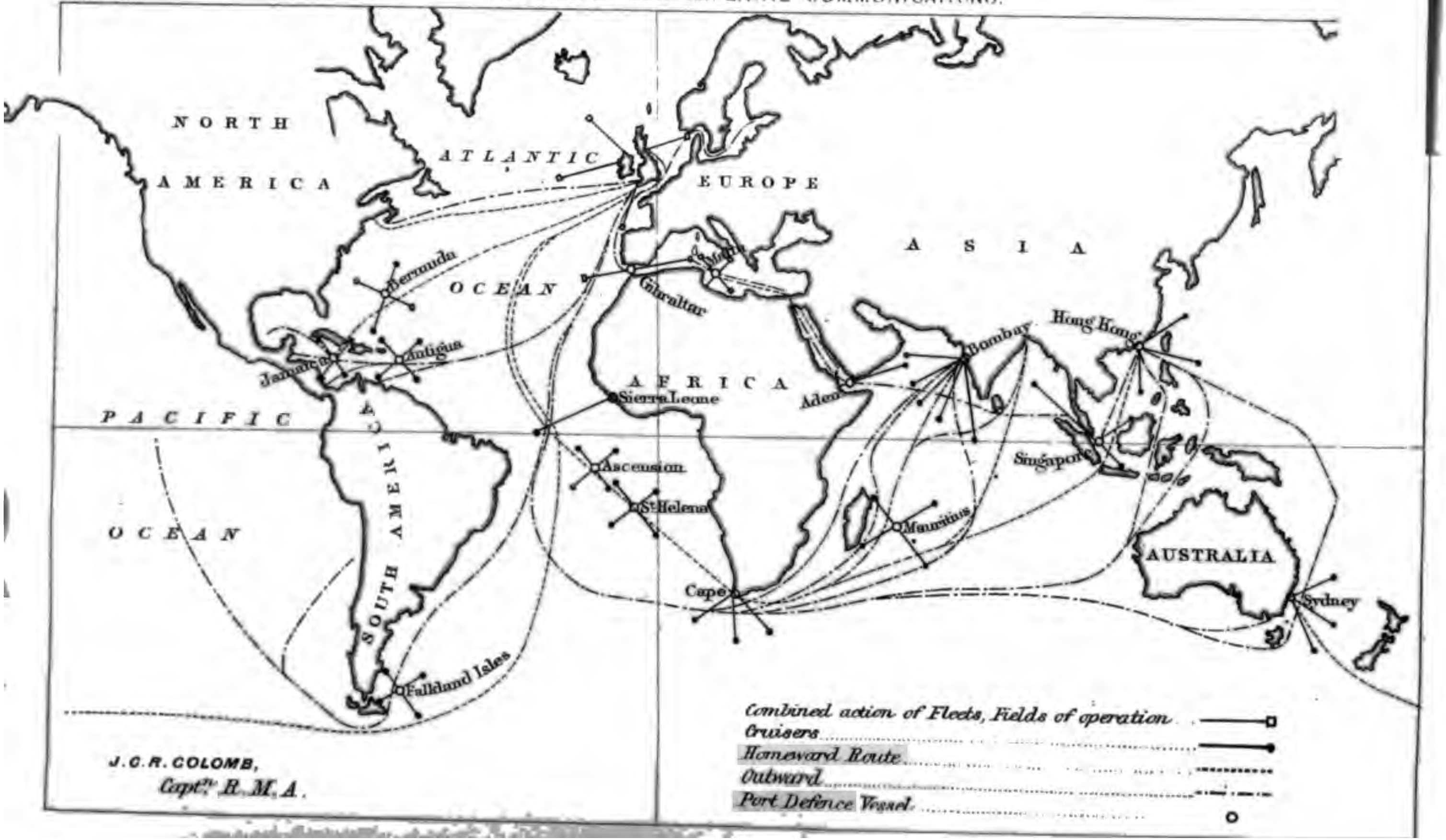
To summarize general principles of distribution so far as the protection of commerce is exclusively concerned, it may be said that during peace, force is only required, and to a limited extent, in the Indian Ocean, the Pacific, the South Atlantic, and part of the North-West Atlantic; during a war with European powers, our naval strength must be applied to the securing the Channel and Mediterranean; but should we be at war with the United States, the distant seas would demand our attention, and the protection of the Channel and Mediterranean would become an object of secondary importance. The principles of distribution of forces to meet the emergency of an European war are exactly the reverse of those adapted to the necessities which would be forced upon us by a rupture with America, they are also the opposite of those suitable to a proper provision for the protection of trade during peace. Our peace distribution would therefore only require expansion, were war unhappily to occur with the United States; but unless we are prepared to put a sufficient force into the Channel and Mediterranean, our peace arrangements would be valueless on the breaking out of war between us and any European power.

The districts into which I have divided the world are large, but they must be regarded as fields of operation, through which the lines of communication pass. It is now time to examine these more closely, and first, let it be remembered that they all find a common end in the Channel, therefore their general security can more easily be placed in peril by an attack upon that position. The nearer home the lines are cut, the more fatal would be the results. Our first duty then is to secure the Channel; our next object is to afford protection to the great roads, so to speak, leading to our most important advanced positions; these routes are—

1. To India and the East by the Mediterranean.
2. To India and China by the Cape.
3. To the West Indies.
4. To the Pacific.

In my last paper I said that "there are many places which, for the "general welfare of the Empire, we must strain every nerve to hold "against all odds." I will now name these. They are those points which occupy commanding positions on or near our lines of communication. For instance Gibraltar, Malta, Aden, and Bombay on the road to India; Ascension, St. Helena, the Cape, the Mauritius, Singapore, and Hong Kong on the route to China and the East; Antigua, Jamaica,

DEFENCE OF OUR IMPERIAL COMMUNICATIONS.



and Bermuda on the line to and from the West Indies; Sierra Leone, the Falkland Islands, and Sidney, are points of value to squadrons acting in the defence of the passage round Cape Horn. It requires no argument to establish the importance of the points on the Mediterranean route, but as the value of others may be questioned, it is desirable that I should give my reasons for selecting them. If we take a map of the Atlantic Ocean, and with a radius of seven degrees describe a circle, the centre of which is on the equator at the point 23° W., the track of nearly all vessels coming from or going to either the Cape or Cape Horn, will be found to pass through the space enclosed by its circumference, the greater number will be found near the centre. Now Sierra Leone is a port conveniently situated, with reference to that point, therefore, it appears to me desirable to consider it as an intermediate station, a place necessary to secure against seizure by an enemy. Ascension and St. Helena lie directly in the track of all vessels coming from the Cape. Vessels going to India after rounding the Cape have five passages open to them, which they take according to circumstances, three of these lie to the west of the Mauritius, and the other two to the east. The great highway of vessels coming from China and the eastern seas to Europe, passes about 5° or 6° to the south of the Mauritius, therefore I think this place may be considered as a point necessary to hold. Singapore is on the direct road from India to China, and with Hong Kong must be held. As regards the West Indian route; vessels, bound for the Greater Antilles or Gulf of Mexico, generally pass between the Islands of Guadaloupe and Antigua, those proceeding to ports more to the southward enter the West Indian seas between St. Lucia and St. Vincent. Antigua, possessing as it does good harbour accommodation, deserves preference as a base of operations for the windward squadron of the West Indian fleet. Jamaica is a good central position on the direct line of communication with Australia and the Pacific *viâ* Panama. Bermuda would be a place of great importance to our fleets during a war with America; it is not much out of the way of the tracks of vessels coming to England from the West Indies. Respecting the route round the Horn there is no choice, we must either dismiss the idea of having any fixed points near the line, or take the two I have named, the Falkland Isles and Sidney. My theory is that any point capable of defence near a line of communication is better than none, especially in this case where thousands of miles must be traversed before any other can be met with. The value of the Falkland Isles as a military outpost cannot be properly understood until we suppose them to be in the hands of America, for instance, with a defended anchorage and a powerful cruiser or two in the vicinity.

Indeed, there are two ways of looking at all the places I have named. We should not merely consider their value to us as military outposts and bases of operation for the force employed in keeping open the lines of communication, but we should also picture to ourselves the results likely to be produced, were they in the hands of our enemies. What, for example, would become of India, if Malta and Gibraltar fell into the hands of an European maritime power? What would happen to our commerce and distant possessions were America to seize, as a necessary preliminary operation, all or any of the other points? and what is to prevent such a contingency in war, if it be not the adoption of well digested defensive measures?

They must, therefore, in peace be prepared for the part they would have to play during maritime war, and each naval station with its head-quarters so placed on the lines of communication, should have a distinct constitution and independent existence under one direction—that of its naval commander. Such constitution must be adapted to the requirements of peace, and capable of such expansion, as would become necessary when maritime war occurred. At his disposal should be placed—

1stly. A sea-going fleet for patrol duty at trading ports in his district, not in the possession of civilized powers.

2ndly. A small garrison for his head-quarters and for minor coast operations on other parts of his station, should such be necessary, together with supplies, stores, and means of repair. In war he must have a sea-going fleet equal to the task of keeping open his communications, a defended port, and a sufficient garrison to prevent the port being taken in reverse, with increased stores and means of repair.

The grand base of our naval operations throughout the world is the United Kingdom, but the enormous pressure which would be brought to bear upon our home arsenals on the breaking out of maritime war, points to the necessity of making Bombay a great reserve depôt for war fleets in the Indian, China, and Australian waters. Having alluded to general principles, I will now attempt to draw the outline of distribution consistent with them.

Ships adapted for the combined action of fleets should be kept at home or in the Mediterranean. Cruisers adapted to war service should, if not in commission, be laid up in reserve at home ports, at Bombay, and at the head-quarters of the naval stations. Small vessels are best fitted for the protection of trade during peace. It would be a waste of force to employ powerful ships against semi-civilized or barbarous foes. These small vessels might be kept in repair at their squadron head-quarters, the war cruisers in reserve furnishing the means of transport, out and home, of the naval forces of the station; they would thus only be in reserve whilst their crews were employed in the heavy gun-boats. The number of port-defence-vessels required, is at present a matter of conjecture, but, in order to illustrate my plan of distribution, it is necessary to suppose some fixed number. I will therefore allow three for Malta, and, although Gibraltar cannot be seriously damaged by bombardment, it is desirable to secure the anchorage, and to have a small force localized in the Straits, therefore say two for that place, as also for the port at the Cape, Bombay, Singapore, Hong Kong, Jamaica, Antigua, and Bermuda, and one for each of the other depôts—that at Sierra Leone being in reserve—26 in all.

Now, the sea-going ships for the Channel and Mediterranean service chiefly require good gunners and good stokers; but, as the use of sails is a valuable auxiliary, it is desirable they should be manned by seamen. Cruisers ought to be first-rate sailers as well as steamers, therefore they *must* be manned by seamen. To man the port-defence-vessels with seamen would be a total misapplication of the services of a class difficult to obtain, and urgently required elsewhere. Now these considerations affect to a considerable extent the internal distribution of our naval forces.

As port-defence-vessels would be incapable of leaving the head-quarters of the station, it follows that when we are at peace with powers from whom offensive operations may be expected, the force employed in them is available for other duty, such as effecting repairs peace-garrisons, at the same time being ready for minor coast operations. If, therefore, the peace-garrison is composed of an auxiliary force to the Navy, all in excess of the complement required for the port-defence-vessels would be a real reserve for sea-going ships in time of maritime war. Now the Marine forces, composed of artillery and infantry, are exactly adapted to such service, and, on the other hand, such duty is exactly adapted to keep them efficient as a reserve for sea-going ships; there would be no charge for transport, as they would take passage, out and home, as supernumeraries in the men-of-war, and so learn their duties in those ships—the foreign service being limited to three years at a time. The complements of such vessels may be taken at 200 men, 50 of whom should be artillery, and 50 stokers. At each port there should be a coal depôt, the men employed for coaling might be organized and trained for stokers' duty in these vessels, forming a port-marine-militia attached to the regular force. If, therefore, we allow 50 artillery and 150 infantry per vessel, there would be really 50 infantry supernumeraries to each. But as the sea-going fleet in China must ever be considerable, 300 marine infantry, in addition to the force required for port-defence-vessels, might be quartered at Hong Kong. At Bombay an increased force of Marines would be well placed as a reserve either for the Indian or Mediterranean fleets. I will allow for that place 300 additional infantry. According to the foregoing calculations, 1,250 artillery and 4,350 infantry would be required for service abroad. This would leave under the present establishment, 1,810 artillery and 7,290 infantry at home, as an available reserve for the Channel and Mediterranean fleets, for which service they could be kept efficient by embarking recruits as supernumeraries for a short period during each year.

Now, as regards the Navy proper. I think it fair to assume as a basis of calculation, that we should be at all times prepared to place in the Channel and Mediterranean, a fleet double that of France, in order to allow for the contingency of combination against us. France has, I believe, in commission, ready in reserve or approaching completion, 60 iron-clads, carrying in the aggregate 786 guns. The complements of our iron-clads may be taken at about 25 per gun; therefore to man an iron-clad fleet double that of France in number of guns, we should require about 40,000 Officers and men. If we have, and are prepared to man, a fleet of that magnitude, our imperial base and the Mediterranean would be tolerably secure.

Next as regards the Navy of the United States.

Mr. Hamilton, late of the Confederate States' Navy, in his able lecture* here last year said, "It needs no penetration to divine the "future naval policy of the United States—it is to hold its coasts "and harbours safe from blockade and attack . . . . With the "coast secure, and the harbours open, the ocean is to be covered with "a swarm of swift cruisers, and letters of marque." Now we require no preparation as regards letters of marque, but it is necessary we should be ready to meet the regular war cruisers of America. More or less adapted to the purpose, she could turn out 141 vessels, carrying in the aggregate 1,442 guns. The complements of our cruisers may be taken at, say 20 per gun—therefore to man a cruising fleet equal to hers, we should require about 29,000 officers and men—*these should be seamen.* As I have shown that in the unhappy case of a war with America, the Channel and Mediterranean are not directly exposed to attack, a large proportion of the 40,000 retained near home for European service would be available for duty in our war cruisers. By sending overland the number required for ships in reserve at Bombay, the Indian Ocean could be secured almost as soon as the Atlantic. The forces in the smaller vessels composing our peace squadrons abroad would at the same time turn over to the heavy cruisers in reserve at their headquarters. Thus might our peace distribution be expanded. To meet the exigencies of an European war, the concentration at or near home of our naval forces, is absolutely necessary, while such an arrangement can without difficulty be adapted to the contingency of a war with America.

The force provided for the service of our fleet and coast guard (exclusive of Marine forces) for the year 1868-9 was 52,070—from this number the following deductions must be made:—

3,100 untrained boys.
1,270 complements of Indian troop ships.

Leaving a balance of 47,700 officers and seamen disposable. I count the Coast Guard as part of the Channel Fleet in reserve. Assuming the Marine force to be distributed as proposed, the number of that force likely to be always ready for service in the Channel and Mediterranean Fleets is a fair set off against the above deductions, and therefore leaving untouched the 40,000 for these fleets, we have 12,000 Officers and seamen available for the protection of trade in peace, enough to man 80 vessels with average complements of 150 per vessel. Considering that all civilized nations are deeply interested in the safety and security of trading operations during peace, and that this number nearly equals the total fleet of America at present, I presume it may not be considered too small. It would not be desirable to reduce our peace squadrons to a very low standard, because such employment is necessary for training both officers and men. This purpose would be more fully answered by the proposed distribution of Marine forces; so many Marines might annually be embarked for a trip round the station—a corresponding number of seamen being disembarked for the purposes of discipline and instruction on shore, and still there would always be available labour for repairs, &c., at each head-quarters. In order to illustrate the general outline of distribution proposed, I have drawn up Table C. I have taken the average complements of war cruisers at 500, those for peace at 150. It would be inconvenient, involve unnecessary expense, and needlessly absorb many men, were there a large number of war cruisers in temporary reserve at each head-quarters, therefore, three is the maximum I have allowed; supposing war to occur, the peace squadrons would be called in to their respective head-quarters, their crews turning over to the war cruisers. At Hong Kong 3,000, and at Singapore 250 would still be disposable, and would proceed to Bombay to man the vessels there in reserve. Aden and the Mauritius would require 50 to complete, but the marine supernumeraries would temporarily meet the difficulty until further reserves arrived. At the Falkland Islands there would be a large excess, on the coast of Africa a deficiency, but by detaching two peace cruisers from those Islands to the Cape, the war cruisers there might be fully manned. Each squadron might still retain a small reserve of seamen in addition to its final Marine Reserve. As there is no head-quarters for the Pacific Squadron, I suppose cruisers of the heaviest class to be always on that station. I here wish to observe, that all my tables are merely for the purpose of illustrating general principles. I do not presume to fix the number required for the protection of commerce, nor the force necessary for each station. I take 12,000, because it happens to be the balance remaining after deducting 40,000, the number I suppose to be required near home. If 12,000 Officers and seamen are employed abroad, the number remaining for Channel and Mediterranean service, and Coast Guard, would be 35,700. France has I believe actually in commission ironclads carrying 300 guns, to double her peace fleet; we may suppose 15,000 officers and seamen to be actually employed in our Channel and Mediterranean Fleets. The Marine Infantry being disembarked from the Coast Guard ships, would leave vacancies for some 1,200 seamen, bringing the Coast Guard service up to nearly 9,000, leaving about 11,700 officers and seamen available for service, either in effective sea-going ironclads kept for harbour duty, or in barracks—this would be our first, the Coast Guard the second, the Marines and Marine Artillery at home, the third Reserve. The whole distribution of our naval forces would then be as shown in Table D.

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* See paper on "The American Navy; its Organization, Ships, Armament, and Recent Experiences," by J. Randolph Hamilton, Esq., late Confederate States' Navy.—Journal of the Royal United Service Institution, vol. xii, No. 49.

The proportion of home to foreign service for the Navy proper would be about the same as that for the marine services.

I propose to exclude the marine forces as part complements of sea-going ships in time of peace, for these reasons:—

1st. Because so employing these auxiliary forces leads to the exclusion, from participation in the active duties of their profession, of a corresponding number of naval Officers and seamen, at present about 8,000.

2ndly. If any real necessity for so employing the marine forces exists, it is because the Navy has not barracks, opportunities of instruction and a proper organization, therefore it would be resting any plan of distribution on a false basis to assume that such a state of things is to be considered a permanent institution.

3rdly. Because by distributing them as proposed, their efficiency as a reserve for service at sea would be fully maintained, that of the artillery as a gunnery reserve, that of the infantry might be increased, for by its employment at the various places where temporary repairs were effected, it would in time become a corps of combatant naval artificers. Whenever there was fighting to be done, the marine forces would still be ready to hand on each station, and a large force would be at home ready for big or little wars, for service ashore or afloat.

It may be plausibly asserted that if it be possible to dispense with the services of the marine forces, as part complements of men-of-war, these forces are no longer required. But be it well remembered that the seaman's profession is a marketable trade, that of a marine artilleryman or marine is not. The merchant navies of the world bid high for British seamen, the demand constantly increases, the supply continues to diminish, therefore a naval auxiliary force not affected by inducements which create constant fluctuations in numbers available, is essential to the very existence of a large Navy.

The advance in mechanical appliances and the increasing scarcity of seamen, will add year by year to the value of this description of naval force, but to my mind it should not be employed to the exclusion of seamen, it should be held in reserve and kept efficient by other means during peace. At present about one-seventh of a ship's complement is composed of marine artillery and marines, in the event of a sudden increase to the fleet being necessary no seamen could be spared from the ships in commission, on the other hand if the marine forces are kept efficient in the way proposed, and by attaching them as supernumeraries occasionally to sea-going ships, the complements of which are entirely composed of seamen, the fleet could be expanded by one-seventh at any moment. It would be always advisable to keep a large proportion of the marine force at home to provide for the eventuality of a great maritime war, when the complements of additional ships would necessarily be composed of untrained and undisciplined men, entered hastily for service in the fleet.

We now come to that part of the question which has special reference to the Army.

In the case of Ascension, St. Helena, the Falkland Islands, and Sidney, the detachments of marine forces would be sufficient peace garrisons, but the other points would require additional force.

The quartering of the British Army for a long series of years at places like Hong Kong, Singapore, Mauritius, Aden, and the West Indies, is fatal to health, and consequently to efficiency, and results in loss of valuable life and vast expense for transport. There is no variety, no change from the monotony of a listless garrison life at such places. While advocating the withdrawal of our regular British Army from such duty, I do not suggest to replace it by increasing the number of the regular marine forces already proposed to be quartered at those points, because such an arrangement would merely shift the disadvantages from the Army to the Marine services. It would be sible to keep large bodies of marines efficient as a naval reserve, s the Officer commanding the station had a very large sea-going t his disposal. Where the forces of marines at a naval head- ers exceeded the means of instruction afforded by the sea-going the power of giving instruction, change and variety by occasional kations for a trip round the station would be lost; this would lead ease and impaired efficiency in the marine garrisons; we must look here to meet the difficulty. Bombay being the supposed head- ers of our fleets in the Indian seas, I would propose a native e force being raised, with its head-quarters at that place. It not be necessary to use these troops for service at sea, but y for garrison duty, and furnishing available labour at Bombay, ape, Mauritius, Singapore, Hong Kong, and Aden. The regular e forces would be the European nucleus to which this native force a similar organization would be attached. They would take ge from and to Bombay in the war cruisers, and the term of e away from that place would be the same as that of the regular , viz., three years. This force should be under the control of dmiral commanding at Bombay.

v, this arrangement would meet many of the difficulties brought rd in the report of Major Anson's Committee. It would be a ry force, used for military purposes, but under naval control.

West Indian regiments would, in the same manner, be formed West Indian marine force. Thus, in time of peace, the Naval commanding on each station, occupying a fixed position at his uarters, would be the one military executive authority respon- or the preservation of internal order at his head-quarters, with a nd military force at his command for the repression of disturb- in any part of his district. In war his place should be at sea, arine forces would defend his port from bombardment, and the ty of the naval bases of operation throughout the world would e upon the Army, till then, necessarily held in reserve. I say arily held in reserve, because we know not from what quarter ay expect attack. It may be of a nature requiring all our th to be put forth at home, it may more directly threaten India, or have for its object the gradual exhaustion of our commercial and y strength by the cutting off our lines of communication at distant . For each and all of these contingencies we must be prepared. if the Army be employed at detached points all over the face of obe, and circumstances required its presence at home or in India, uch time would be lost before it could receive its recall? Add to e time it would take to return, and estimate the consequences of if you can! On the other hand, the declaration of war by a from whom assault on distant possessions might be expected, be the signal for the despatch of troops ready at hand to the r of the garrisons along the lines of communication. Having en up a proper defensive position, we could then, under cover of ets, develop our resources, and use these defended points as of *offensive* operations, from which flying brigades drawn from anœuvring army of the empire might act either in the defence of our possessions in the vicinity more immediately threatened, or for the purpose of creating a diversion in favour of others by retaliation against those of our enemy. Jamaica, Antigua, and Bermuda might thus be applied to the defence of the West Indies, or to the relief, however small, of "Canadia."

This brings us back to the point from which I started in my first paper—home distribution. We must view the regular military forces in the United Kingdom from three distinct points of view, as reinforcements for India; as a reserve for Mediterranean garrisons; and as the war garrisons (in reserve) for naval head-quarters throughout the world.

For India we require a manœuvring or field Army, and a contingent for garrisons at fortified points; but for the defence of the Mediterranean and all our other out-posts, we should want only a "garrison army," a body of troops trained and adapted to the defence of fortified positions. In my first paper I supposed the foreign service of the regular Army to be limited during peace to India, Aden, Malta, and Gibraltar,* thus bringing the number at home to about 126,000, and I divided the reserve forces for the defence of the United Kingdom into two parts—garrison and manœuvring. I now go a step further, and divide the regular military forces for the defence of the Empire into two branches—garrison and manœuvring.

As regards the first branch, hostilities which would require our small and distant out-posts to be placed on a war-footing would not likely directly threaten the United Kingdom, or the Mediterranean, but any war which would lead us to expect attack at home, would necessitate our filling up the garrisons of Malta and Gibraltar; in either case, a large garrison army would be required.

As our distant out-posts are as yet undefended, it is impossible to estimate for their war garrisons, but, for reasons already given, I balance the force necessary for that purpose against that required for home and Mediterranean fortresses. I assumed that at the moment of expected attack, *one-third* of the total garrisons of fortified places at home should be regular troops; that would be about 22,000 (exclusive of Cork harbour, and Alderney, which would require about 2,000 more), I believe 30,000 may be taken as the lowest estimate for Mediterranean garrisons under similar circumstances; therefore, our total regular garrison army should not be less than 54,000. I take the following general principles as a guide in distributing this force:—

1st. The head-quarters of the forces intended for the defence of fortified places abroad, should be fixed at the fortified places at home,† in order that they may be trained to the peculiar nature of the duty they would have to perform in war.

2nd. The strength of the garrison army so quartered in the United Kingdom, should be such as would permit of its furnishing the force required to raise the garrisons of Malta and Gibraltar from a peace to a

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* India,	64,000
Aden Malta Gibraltar	10,000

† For detail, see Part I.

war footing, without reducing the number of regular troops in these home fortresses below the number necessary for their own defence.

It would occupy too much of your time, were I to go closely into details relative to each defended point, and therefore I shall deal with the subject of barrack accommodation in a very general and rough way.

At the end of the Report of the Defence Commission, you will find that the works proposed and in progress for the defence of these places were estimated to accommodate about 30,000 men, to this must be added barracks actually in existence which may roughly be computed to hold 18,000,* therefore supposing the works to be completed, there would be room for about 48,000. I proposed to raise the Mediterranean peace garrisons from one-third to one-half the total estimated war garrisons, thus bringing the force quartered there in peace to 15,000. Further, as barracks are a great naval want, I propose to give up accommodation for 8,000 of the first reserve at Chatham, Portsmouth, and Plymouth, the money which would otherwise probably be devoted to building naval barracks, being applied to the construction of quarters elsewhere for the "Manœuvring Army." Under these circumstances the garrison army at home would number 39,000, and there would be quarters for about 40,000. It will thus be seen that the garrison army could be localized at these fortresses—the defended points at home would be the great feeders of all our fortified positions abroad, and in turn be fed in Great Britain by the Reserves in the surrounding districts, they would in fact be the great Artillery and Engineer centres both regular and reserve.

In Table 2 (Part I) you will see that 16,921 is the number of Militia in the counties I have grouped together to furnish the Reserves for these fortresses; under the proposed distribution 15,000 regular troops would move from thence to the Mediterranean when danger appeared, therefore by calling out the Militia at their fixed head-quarters, the vacancies so caused would be completely filled.

Whether the garrison army, regular, and reserve, should exclusively consist of garrison Artillery and Engineers, or be partly composed of Infantry, always associated with or attached to these scientific branches for the performance of minor duties is a question of organization, not distribution, but I remark in passing, that so far as I have been able to ascertain, our regular garrison Artillery, even, if withdrawn from colonial service, could only furnish for home and Mediterranean fortresses about two men per gun, if so many.

Now, as to the distribution of the regular "Manœuvring Army" at home. Under all the supposed circumstances it would number about 82,000 Cavalry, Field Artillery, Infantry, Train, and Staff. For reasons given in the first paper, I do not attempt to deal with the internal distribution of regular forces in Ireland—the number to be employed depends upon circumstances of a political character. As, however, it appears by Appendix K, p. 26, to the Report of the "Commission of Recruiting," that about one-fifth of the total number of recruits for the line during the five years ending 1865, was raised in Ireland, 20,000 men may be considered a fair proportion to fix for service in that country, thus making allowance for the necessary deductions on account of the force in India and the garrison army. This number at all events will answer the purpose of illustration, and there is I believe ample accommodation there for that number.

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* Marine barracks not included.

Sixty-two thousand now remain disposable in those divisions of Great Britain furnishing the Reserves for the Manœuvring Army, as explained in my first paper. This would allow an average of about 5,000 regular troops to each division so formed, but the exact number to be allotted to each, however, would depend upon a variety of circumstances—the strength of the regular Reserves, for example—which I do not now intend to enter upon in detail, but I will sum up as regards barrack accommodation for the Manœuvring Army in Great Britain in this way. Within the limits of that part of Great Britain which I have allotted to the Manœuvring Army, there is barrack accommodation for about 37,000 men, including Aldershot, which is the head-quarters of the First Division, though situated in one of the counties of the Portsmouth district; therefore under the supposed arrangement, quarters would have to be provided for 25,000 men; but I remind you that this proposed distribution provides barracks for the Navy, and reduces the annual charge for transport of troops by about £250,000 per annum, which represents £5,000,000 at 5 per cent., and this sum would build barracks according to the Defence Commission estimate, for 50,000 men.

I would propose to build these barracks at the head-quarters of each *Brigade District*, in order that the Militia might have the use of them.

One of the recommendations of the Militia Commission of 1859,* was that the Militia forces should be "trained annually," and, if possible "simultaneously." Now it would be possible to apply that principle not only to the Militia, but to all our war forces at home, and so make one branch check the other, and all rehearse the business of defensive war in the spring time of each year.

The first force to move out to face an enemy must ever be—the Navy, therefore the 8,000 seamen should embark each year in the reserve ships for Channel service, the militia of the garrison army moving into their barracks; in like manner a portion of the marine barracks could also be made available for the reserves. The regular troops of the Manœuvring Army quartered at the brigade head-quarters should move to the divisional head-quarters and encamp, the militia moving into the barracks thus vacated, and during the last week of training, join the regular troops of their division at the temporary camp, thus leaving barrack accommodation vacant for other reserves of the district. If there were no reserve ships ready, there would be no barracks vacant for the garrison militia; if camping arrangements were not in working order, the training of the manœuvring militia would come to a dead lock; thus would one department check the other.

I have carefully avoided touching the subject of "organization," for that is a thing entirely subservient to "distribution."

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* See Blue Book.

We are apparently on the eve of great changes, and therefore it is essentially necessary that we should not lose sight of the end—"the safety of the Empire"—for which our war forces exist. In this room last year it was truly stated,* as a principle that "it is wiser "to concentrate the resources of a country on the fortifications "of the principal arsenals, so as to secure them against capture, than "to expend the same resources on many comparatively unimportant "points which, from their isolation and weakness, invite attack and "afford cheap victories." Now, viewing the whole Empire as a country exposed to attack, it may be said that it would be better to turn our resources to the purpose of securing points that command our communications, than to fritter them away in attempting to defend a variety of unimportant positions. How far we have hitherto acted upon this principle may be gathered from the fact that the estimated imperial military expenditure upon our colonies and dependencies for the year 1864–5 amounted to about £3,500,000, and of this sum only about £1,300,000 was expended upon the outposts I have named. Now if these positions are lost to us, the safety of our communications is gone; that being the case we could do little to assist any of our distant possessions in time of need. Why then expend nearly two-thirds of our available resources upon unimportant points which would afford cheap victories, whilst but one-third is spent upon positions the loss of which would involve the whole Empire in a state of commercial and military paralysis? As regards the United Kingdom (the citadel of the Empire), let it never be forgotten that we have two dangers to guard against—direct assault, and investment, partial or complete. Though these islands may bristle with bayonets, though at the very name of invasion millions of riflemen may be ready to line the hedge-rows, let us not shut our eyes to the fact that our supplies might be cut off, that we could be, in short, starved out. Therefore must our war forces be distributed in such a manner as will best secure the imperial base of operations, and ensure safety and freedom to our imperial communications.

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* See lecture before referred to.

APPENDIX.

Table A.

Distribution of British Commerce.

Approximate Value, 1867.

	£
Ports on Baltic	38,000,000
" North Western Atlantic	100,000,000
" Round Cape of Good Hope	91,000,000
" German Ocean	81,000,000
" North East Atlantic	66,000,000
" Mediterranean	66,000,000
" South Atlantic	27,000,000
Round Cape Horn	31,000,000
	£500,000,000

Table B.

Table showing approximate value of Articles *en route* to and from the United Kingdom, over certain divisions of the Atlantic Ocean, 1867.

To and from Ports.	Waters in United Kingdom.	North East Atlantic.	Southern Atlantic.	North Western Atlantic.
	£	£	£	£
Baltic	38,000,000			
German Ocean	81,000,000			
North Eastern Atlantic	66,000,000	66,000,000		
Mediterranean	66,000,000	66,000,000		
South Atlantic	27,000,000	27,000,000	27,000,000	
North West ditto	100,000,000	100,000,000	..	100,000,000
Round Cape Horn	31,000,000	31,000,000	31,000,000	
" Cape of Good Hope	91,000,000	91,000,000	91,000,000	
	500,000,000	381,000,000	149,000,000	100,000,000

TABLE C.
PEACE Distribution, exclusive of Channel and Mediterranean.

Grand Base.	Station.	Squadron Head Quarters.	Port Defence Vessels.	War Cruisers in Reserve.*	Peace Cruisers.†	Officers and Seamen.	Port Defence, &c.		If War Cruizers require to be manned. Officers and Seamen.	
							Artillery.	Infantry.	Surplus.	Deficiency.
Bombay ..	China..	Hong Kong ..	2	3	30	4,500	100	600	3,000	
	East Indies	Singapore	2	1	5	750	100	300	250	
		Aden	1	..	3	450	50	150	..	50
		Mauritius	1	1	3	450	50	150	..	50
	Australia	Sydney	1	1	4	600	50	150	100	
United Kingdom	Coast of Africa	Cape	2	2	3	450	100	300	..	300
		Ascension	1	1	5	750	50	150		
		St. Helena.. ..	1				50	150		
		Sierra Leone ..	1	In reserve.						
	S. E. Coast of America..	Falkland Islands	1	1	6	900	50	150	400	
	West Indies	Antigua	2	1	4	600	100	300	150	
		Jamaica	2	1	4	600	100	300		
		Bermuda	2	1	3	450	100	300		
	Pacific	.. ..	..	3 (in commission)	..	1,500				
					Bombay ..		100	600		
						12,000	1,000	3,600		

* Average complement taken at 500. † Average complement taken at 150.

TABLE D.

DISTRIBUTION OF NAVAL FORCES.

	Officers and Seamen.	Marine Forces.		Totals.
		Artillery.	Infantry.	
On distant Stations	12,000	1,000	3,600	16,600
Malta..	.. ..	150	450	600
Gibraltar	.. ..	100	300	400
In Peace Fleets				
Channel and Mediterranean ..	15,000	.. ..	.. ..	15,000
At Home Arsenals	11,700	1,810	7,290	20,800
Coast Guard..	9,000	.. ..	.. ..	9,000
In Indian Troop Ships	1,270	.. ..	.. ..	1,270
Untrained Boys	3,100	.. ..	.. ..	3,100
Total ..	52,070	3,060	11,640	66,770

Present Establishment (1868–9) 66,770.

Evening Meeting.

Monday, February 1st, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES OF MEMBERS who joined the Institution between the 18th January and the 1st February, 1869.

ANNUAL.

Acton, E. W. F., Capt. 1st Roy. Cheshire Mil. 1*l.*
Sayer, J. R. S., Col. Asst. Commt., Cav. Depôt, Canterbury. 1*l.*
Studdert, R. A. Fitzgerald, Capt. Lond. Art. Vols. 1*l.*
Wilson, Charles W. H., Capt. 6th The Royal Regt.
Cockburne, James G., Capt. 6th The Royal Regt.
Harrison, Thomas P., Capt. 107th Regt. 1*l.*
Gordon, Robert W. T., Lieut., 93rd Highrs. 1*l.*
Trotter, Henry, Lieut. Roy. Engrs. 1*l.*
Innes, J. M. McLeod, V.C., Major Roy. Engrs., Bengal. 1*l.*
Thackeray, E. T., V.C., Capt. Roy. Engrs. Beng. 1*l.*
Ready, John T., Capt. 66th Regt. 1*l.*
Stephens, Edmund, Lt. Roy. Engrs. 1*l.*
Henderson, W. Hallam, Lieut. Royal Engrs. 1*l.*
O'Brien, E. D. C., Lieut. Roy. Engrs. 1*l.*
Wallace, Charles J. S., Lieut-Col. 25th K. O. Borderers.
Ruddell-Todd, James A., Major 25th K. O. Borderers.
Scriven, Horace W., Capt. 25th K. O. Borderers.

RECOIL DELICATELY CHECKED AND UTILISED.

By Lieutenant-General W. N. HUTCHINSON.

Read by Captain ROBERT SCOTT, R.N.

THE increasing power of resistance constantly added to defensive armour gives a proportionately increasing importance to ordnance throwing heavy charges, and bespeaks a careful consideration of any proposed improvement in the principle of checking recoil, for it is well known that the range and efficiency of powerful guns are much diminished from the inability to fire as large charges of powder from them as would be practicable, were it not for the evils arising from the great recoil occasioned by large charges. In August, 1863, the Ordnance Select Committee reported "that wrought iron guns might "be made lighter than they are, or be used with heavier charges, if "the recoil could be more effectually checked." The present proposition for more efficiently checking recoil is by the use of the most elastic and inexpensive cushion known, viz., the common atmosphere, which can be employed in the most delicate, yet effective manner, and to any amount.

The application is by the use of a closed cylinder, with a piston and rod working in it, having much air on one side of the piston, and very little on the other (see Plate v, figs. 1 and 2).

When recoil takes place, the piston is forced into the part containing the greater body of air, which is thereby compressed, while at the same time the air on the other side of the piston is proportionably rarefied. The increasing resistance of the air thus gradually and quietly receives and absorbs the force of the blow from recoil. This smooth absorption of recoil allows of the employment of a gun much lighter than the ordinary gun, supposing the weight of powder and shot to be the measure of the similarity in both.

To utilise the rebound that would instantly occur from the elasticity of the highly-compressed air, a self-acting catch (or other contrivance) retains the gun (with carriage) in its back position until loaded; then, when the catch is released, the pressure of the compressed air against the piston most usefully assists in running out the gun to firing position.

With very light guns (which are particularly desirable on turntables) when very heavy charges are fired, the air will be more compressed by recoil than is required to return the gun to firing position. This stored-up-force can be smoothly eased off by means of a light hand-rope rove through double-sheaved pullies, or be controlled by means of a friction band, &c. But were all precautions neglected little inconvenience could arise; for the air that had been rarefied at one end of the cylinder, becoming in its turn gradually compressed as the gun resumes its firing position, would act as a soft cushion, and prevent mischief at the termination of the rebound.

Fig. 3.—When a gun is mounted on an ordinary carriage, the cylinder, constructed as shown in Fig. 3, is attached to the carriage below the gun, not far from the trunnions. The piston-rod lies nearly horizontal in a vertical plane with the axis of the bore, the exterior end of the rod being towards the muzzle. This end of the rod plays freely in a ring (or circular staple, or eye) fixed below the sole of the embrasure or port-hole. Thus the free training of the gun is not in the least impeded. When the gun recoils, it carries the cylinder with it, compressing the air in front of the almost stationary piston. All the force of the recoil is thus absorbed without friction, and without causing the least jar or strain to any part of the carriage or platform, for it is obvious that all the horizontal strain is borne by the ring.

For the sake of security this ring might play in the angular part of two strong iron bars joined together in the form of a letter V, running for many feet horizontally through the parapet. To the extremity of these bars would be attached large flat bars or beams, fixed crosswise and vertically in the body of the parapet.

SKETCHES

Fig 1

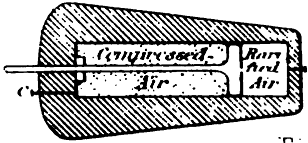


Fig 2

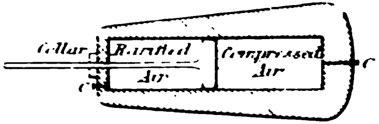


Fig 5

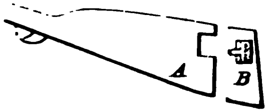


Fig 6.

Fig 3.

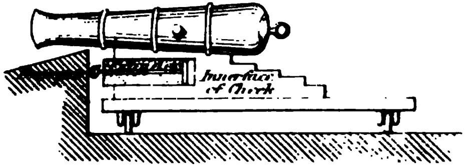
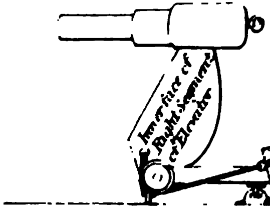


Fig 4.



Part of Moncrieff Carriage 7 inch Gun.

Fig 8.

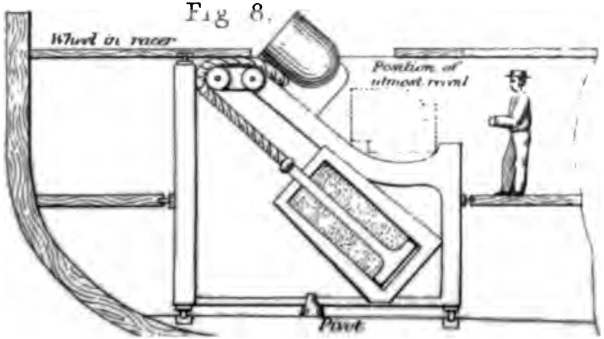
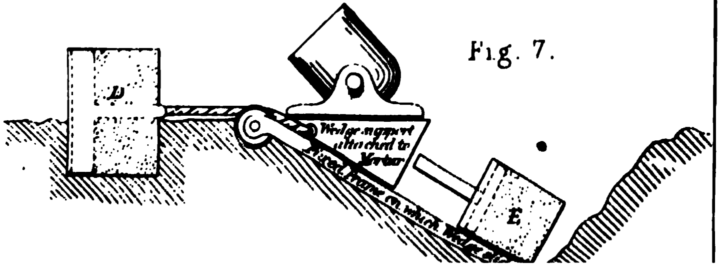


Fig. 7.


D
E
Wedge support attached to Mortar
Fixed Frame on which Wedge sl

In applying the cylinder, made according to Fig. 1, as a substitute for the weight in Moncrieff's carriages, it would be firmly attached to the after-part of the traversing platform.

A flexible rope (passing over a pulley, fixed vertically, in the front and lower part of the platform), would be attached to the exterior end of the piston-rod, and would connect it with the centre of the horizontal cross-bar which unites the front extremities of the toothed segments constituting the sides of the carriage. The rope intervening between this cross-bar and the end of the piston-rod would be about the length of the rod, which would be the measure of the limit of recoil.

Recoil would cause the trunnion-ends of the segments to roll inwards with the gun, and sink below the crest of the parapet,—the too sudden elevation of the other ends being, soon after starting, gradually more and more resisted by the gradually increasing density given to the air by the rope pulling forward the piston.

The cylinder, if sufficiently increased in diameter (therefore in power), need only be half the described length, were the rope, when fastened to the front of the traversing platform, to be passed through a pulley fixed at the exterior end of the piston-rod before it passed over the other pulley.*

By a little alteration of the disposition of the parts which connect the sides of most gun-carriages, ample space would be found for the proper adjustment of the cylinder.

Marks on the rod would show at all times the exact position of the piston within the cylinder.

C, *C*, *C*, *C*, are air-cocks occasionally turned to allow the entrance or escape of air, and thus regulate to the greatest nicety the resistance to be given by the compressed air, and the length of the stroke of the piston. It is clear that the less the air is admitted into the vacuum-end of the cylinder the greater will be the resistance of the compressed air, and consequently the less will be the length of stroke, and the less the length of recoil. This principle of checking it, gives such absolute control over the gun, that all rapidity of recoil might be prevented *ab initio*. By bringing the piston home to the head of the cylinder there would be practically a perfect vacuum at that end, when the gun's starting to recoil would be resisted by a pressure exceeding 14 lbs. per square inch of every inch of the piston's area, even should the cylinder be only charged with air of natural density.

Were there any advantage in the arrangement (which is doubtful), any greater resistance at starting could be made uniform during the whole of the recoil by means of a safety-valve placed at the end of the cylinder, whose spring would more and more yield to the escape of air as its pressure increased. It must be obvious that were the end quite open, the pressure might always be 14 lbs. to the square inch, both for resisting recoil and for running out the gun.

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* When cramped for space, instead of the compressed-air end of the cylinder being closed in the usual manner by having a globulous reservoir attached to the sides near the end, and the lowest part of the sides thus encased pierced with holes communicating with the reservoir, the piston might be driven home the full length of the cylinder.—W.N.H.

It has been suggested that there would be danger of leakage of air were the gun retained for hours in the loading position,—but manufacturers will assure you that with careful workmanship, there need be no apprehension on that score. The motion of the piston is slow. The pressure of the condensed air, unlike that in a steam-cylinder, is always on one and the same side of the piston, therefore the compressed air is constantly forcing the soft, well-greased packing into any crevice that might otherwise exist between the uppermost plate of the piston and the side of the cylinder. Moreover, the collar round the piston-rod being always in the air of greatest density (inside the cylinder, Fig. 1, outside the cylinder, Fig. 2), is always pressed against the piston-rod, which prevents any escape in that part,—but were there even a slight escape, it could readily be replaced by the air-pump.

In the two foregoing instances of recoil being checked, it was resisted by the piston-rod being partly drawn out of the cylinder, but in the case of wall-pieces and all arms fired from the shoulder, the force of recoil could be met by the piston-rods being driven into the cylinders (see Fig. 2).

The stocks of such pieces would be in two parts. To the shoulder-plate a small cylinder made on the principle shown in Fig. 2, is fixed within the stock. The part *A* slides within the part *B*, see Fig. 5. The two parts are usually together, as shown in Fig. 6. Recoil drives *A* (say an inch, or inch and half) close to the shoulder-plate, the force of the blow being received on the piston; then *A* returns, by the force of the rebound, to its usual position. Rifled wall-pieces with steel pointed projectiles were much employed by the Americans in their last war, and from their range, precision, and penetration, are likely to be frequently used in future to resist approaches by sap, &c., especially as the adoption of the cylinder would allow of pieces of increased power being manufactured. Only sap gabions of unheard-of diameter could resist penetration from such pieces.

The decks of iron-clads being their most vulnerable point, many think that mortars will be much used in future. It is clear that any arrangement which would admit of their recoiling, would greatly augment their power by allowing larger charges of powder being employed than can now be used. It is believed that no attempt has as yet been made to attain this desirable end, but endeavours have been made, by supporting the beds of mortars on vulcanized india-rubber, to lessen the injurious strain given to a ship on their being fired. These attempts failed, principally from the constant weight of the mortars destroying the elasticity of the india-rubber.

It is now proposed (see Fig. 7), where a traversing platform may not be required, that the carriage shall be somewhat in the form of a wedge,—that on the mortar being fired, it shall recoil or slide downwards (towards the fixed cylinder *E*, and from the fixed cylinder *D*) on a wooden platform lying at such an inclination that the carriage will not slip down, but remain in the highest position until the mortar is fired,—that, after recoil, the carriage, with mortar, shall be retained by a catch in the lowest position (where the gunners will be sheltered) until it be re-loaded,—and that on being released by freeing the catch, the force of the compressed air shall aid the gunners in making it re-ascend. Of course the wheels of the carriage will always self-lock during the descent. Few easier plans could be adopted for effecting this lock than the falling weight on a cogged wheel, as employed in a ship's windlass.

Where it would be inconvenient to place cylinders of such a size that air in its natural state would give sufficient resistance, the power of both the cylinders might be increased by their being charged by an air-pump (attached to the air-cock), with air of the requisite density, as indicated by a gauge.

As there would always be ample space for D cylinder, it could be made of whatever size and power* might be required.

It is hoped that Fig. 8 will give a sufficient general idea of the arrangement proposed when it is necessary that the recoiling-mortar should stand on a revolving platform. In a mortar-boat, a circular hole (say 7 feet in diameter) is cut in the upper deck, also in the lower. The inclined beams that support the carriage and mortar rest on a revolving frame standing on wheels, which travel in a circular groove attached to the bottom of the boat. A projection (terminating in a wheel) from the upper part of the revolving frame prevents its lifting or receding when the mortar is fired. That wheel plays in a circular groove fixed underneath the upper deck, near the edge of the hole cut in it. Against the edge of the lower deck (through which the revolving frame passes to the bottom of the boat) is also a racer in which work horizontal wheels to further steady the frame in a sea or during firing. The skids (or rails) on which the carriage glides are curved upwards towards their lower termination, to assist in checking recoil.

In pits on shore, or wherever additional weight would not be disadvantageous, a counterbalancing weight to the mortar might be substituted for the cylinder.

Some naval men think that the adoption of a few mortars in our iron-clads would much add to their efficiency. If the shells projected, were made to rotate rapidly in the plane of their progress, they would gain in precision and penetration. This, it is believed, could be effected on the principle shown in the wooden model of a 32-pounder disc-gun, now in this Institution, and which was fully described in a paper read here on the 4th of February, 1867.†

The shot on starting is tripped, as it were, by a fixed steel catch, which fits into a notch, or small hole cut on the surface of the shot. This causes the shot actually to spin during its flight, and when alighting on level ground to roll rapidly for a long time in the direction of aim. On striking an object, the force of the blow received is the resultant of the horizontal trajectory and of the velocity imparted to the surface of the shot by the spin. None of the force of the powder is expended in overcoming the resistance to the shot's progress in the barrel (therefore to its initial velocity) caused by rifling.

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* Of any power. The undersigned took out a patent, dated 1st February, 1864, for "Improvements in the construction of Cylinders of Hydraulic Machines, appli- "cable also to the construction of ordnance and other articles, or vessels subject to "pressure from within." It explained how in a cylinder composed of many consecutive tubes, each tube could be made to do as much useful duty as the innermost, in resisting a bursting strain, by a calculated pressure given to the mercury (or any fluid) that slightly separated the several tubes.—W.N.H.

† Printed in No. 43 of the R. U. S. I. Journal, vol. xi.

All these cylinders, which are so simple in their application, would be durable and not expensive, while the certainty and uniformity of their action without the risk of wrong manipulation (for they are really self-acting), promises to give them an advantage over every kind of check from friction, however ingeniously applied; and the fact of the recoil, instead of continuing a detriment, being made to aid the efficiency of the gun by the condensed air serving to run it out after it is loaded, thereby rendering but few gunners necessary, argues strongly in favour of substituting cylinders for compressors on board ship.

It is thought that the employment of them to check the recoil of heavy guns, besides adding to their efficiency in permitting large charges to be used, would, from the entire transference of the usual strain on pivots, racers, and carriages, to the immovable parapet or ship's side, effect a considerable saving in the construction of all that pertains to platforms, as well as a general saving in wear and tear from the absence of all jar and friction. It is further thought that it would effect a saving in the manufacture and alteration of ordnance, for it would diminish the amount of metal hitherto considered necessary to be given to each piece in order to assist in resisting recoil.

A convenient length being agreed upon for the recoil of the gun, what diameter should be given to the piston starting from a state of rest in air of a known density, could be computed in the following manner:—

Let—

a = area of cylinder in square inches.

p = pressure per square inch on piston at commencement of stroke.

s = length of cylinder in feet. Much determined by the pressure it can innocuously sustain.*

l = length of stroke of piston in feet. The length the gun recoils.

Then,

$\frac{s}{s-l}\, a\, p$ = pressure on piston at termination of first length of stroke, and therefore the greatest pressure.

$\therefore a\, p \sqrt{\frac{s}{s-l}}$ = mean pressure during stroke.

$\therefore a\, p \sqrt{\frac{s}{s-l}}\, l$ = total units of work done in first length of stroke in bringing the gun to a stand-still.

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* That pressure per square inch on cylinder will equal $2\,p$ if $l = \frac{s}{2}$

" " " " " $3\,p$ if $l = \frac{s}{3}$

" " " " " $4\,p$ if $l = \frac{s}{4}$

and so on.

Again, weight of gun with its carriage, and of the shot and its initial velocity being known,

If W = weight of gun and carriage in lbs.
w = weight of shot in lbs.
V = initial velocity of recoil.
v = initial velocity of shot.

Then by the Artillery rule,

$$\frac{V}{v} = \frac{w}{W} \therefore V = \frac{w}{W} v.$$

∴ The total number of units of work accumulated in gun and carriage during recoil $= \frac{W}{2g}\left(\frac{w}{W} v\right)^2 = \frac{w^2 v^2}{2gW}$

But this accumulated work is overcome by the work done by the cylinder in bringing the gun to rest.

$$\therefore a p \sqrt{\frac{s}{s - l}}\, l = \frac{w^2 v^2}{2gW}$$

$$\therefore a = \frac{w^2 v^2}{2gW} \times \frac{1}{p\, l} \sqrt{\frac{s - l}{s}}.$$

From this equation the area of the piston becomes known, hence its diameter.

The **Chairman**: If any gentleman has any remarks to offer we shall be glad to hear them. It is a very interesting subject, new to most of us, I daresay; as for myself there are one or two points that I should like to ask a question about, if Captain Scott is in a position to clear them up. First of all, when the mortar (Fig. 8) has recoiled to the position in which we see it, I do not see how it is to be loaded. Next, there seems to me to be a weak point in connection with the wear and tear of the rope round the pivots. The next is a point that I should think would be only determined by actual trial, viz., that in the case of the compression of the air, heat would be eliminated on one side, the compressed air, and cold on the other side, the rarefied air. These are points I think that can only be settled by actual trial. We know that the compression of air, very strongly and very suddenly effected, would liberate a great deal of caloric on one side. The other point that struck me at the time it was mentioned, is the escape of air round the piston. I fancy that would require trial to prove whether it would be so or not. Those appear to me to be the weak points in that system. If any gentleman, who has thought on the subject, would be kind enough to give us his opinions, we should be happy to hear them.

Captain **Buckle, R.N.**: May I ask what there is to prevent the head of the cylinder coming out by the effect of the recoil? How is that controlled?

Captain **Moncrieff**: I should like to ask whether the recoil would be in the direction of the piston, or if it would be lateral?,

Captain **Scott**: As to heat and cold, or changes of temperature, I do not think that practically they would be found to exercise any material effect; I do not think they would be found to be difficulties. The wearing of the rope is a very great difficulty, there can be no doubt of it; there is always a tendency to break at a nip. However, a rope may be made of almost any strength, and with the turret guns, tackles and chains have been found to resist recoil; you have only to make them large enough and heavy enough, and then you can get them to stand; it is mainly a question of weight. A wire rope would have stood but for the nip over the roller, which is certainly awkward. Therefore, you could only use a chain, and a chain of a particular character, viz., a pitch chain coiling over a drum, and I have no doubt that in that way you would get over the difficulty. As to loading, I take this to be rather a fancy sketch than the position in which a mortar would ever be placed. Of course it would not turn up in that way, for it would come down gradually in this line, and then you could load; but in the other case unless you had a platform across you could not load. As to the head of the cylinder going, on the piston being pulled forward, the air acts as a cushion, compressed in the way it is shown, and the air being a cushion would never allow the piston to come close against the head of the cylinder, and strike it, there would always be an amount of compressed air which would act as a cushion to prevent any damage to the head of the cylinder. I do not think there would be any practical difficulty. With regard to another question, the recoil would be in the direction of the piston, which, in this case, would correspond exactly with the water-buffer piston.

Captain MONCRIEFF: Would that be the case with the mortar?

Captain SCOTT: Yes, certainly it would, because if it were laid in the way shown, it would keep as indicated, you could not alter the line, it must really move in it. You have only to get the axis of the cylinder parallel with the line in which the piston is moving; there would be no practical difficulty in that, and then the packing would keep it steady. I confess it is a subject in which we have not many experiments to guide us, and the limits between success and failure are extremely narrow. I do not think the plan should be set aside without very careful experiment. I am sorry that General Hutchinson is not here, because he has gone thoroughly into the matter, and could explain it far better than I can. But granting that it succeeded, it would have a very great advantage over water, which is now being tried. Water, as we all know, is incompressible, and when water is set in motion by the recoil, the great check is at the first instant, and it becomes gradually less. Now, that is a wrong principle; you want the gun to recoil at first as easily as you can, and then to be brought up more and more gradually. If the air would do that, you would have a perfect compressor; therefore, if it can be successfully worked out, it be good plan.

Captain MONCRIEFF: I should not have made any remarks, only General Hutchinson has employed as an illustration a form of carriage which I have introduced, and I think I ought to say a few words about his very interesting programme. The question of absorption of recoil and of utilising the recoil of guns is a problem which has attracted the minds of several mechanical men lately; it is one which possesses very great fascination. There is no doubt whatever that the idea of using an elastic medium so perfect as air to absorb, that recoil, is a very pretty one. I may state to this meeting that four years ago I myself made designs for applying it to the carriage which bears my name. From the drawings, which of course are mere sketches, I am afraid General Hutchinson has not arrived at that stage in the process in which the real difficulties are discovered. The mere idea of applying air is a good one, but there are difficulties lying between the idea and the application of it. I noticed in the remarks which Captain Scott made that he took credit not only for the advantages of the compressed air upon one side, but for the advantages on the other side, which would have been derived from the weight of the atmosphere. Of course, if you use the one, you cannot use the other to the same extent as when the vacuum exists. I would prefer not to criticise the use of ropes passing over pulleys, and the other arrangements which I see depicted there; they evidently represent the investigation at an early stage. I think the subject is one in which there is a great deal to be done, and I hope myself to be able to describe at this Institution, some other methods of applying the same power. With regard to the mortar, it occurs to me that an elastic medium of a more solid character would be better suited for the purpose, and would make the traversing arrangements less unwieldy than those which we see there depicted.

Captain SCOTT: If you would allow me to add one more remark, I would say that General Hutchinson only intended to put forward designs, not finished models; he has merely shown the way in which his system can be applied. And after all, if it can be applied in these ways, you have really the back-bone of the system. Although there are great difficulties to be met, as we all know well there are with every invention, because the limit between success and failure is so exceedingly narrow, still I think they may be fairly taken as well worth very full consideration. With respect to the traversing arrangement, General Hutchinson, I suppose, merely put that in, not thinking that he would be treading upon any person's toes. I think there is nothing more than that in it, for many arrangements can be made to traverse the gun without a rack and pinion, which is perhaps the simplest plan. I think, however, that the discussion of this subject should be directed rather as to whether air cannot be usefully employed, than to any particular details, and this seems to be the object that General Hutchinson has in view.

Major-General Boileau, F.R.S.: I should wish to say a word before the subject closes, merely to give a general opinion upon the project, because it is simply a project at present. The question of utilising recoil has for some time occupied the attention of the authorities, and that some method of this kind is desirable, it occurs to me, is proved by the fact of the water-buffer, or the application of water for the same purpose as this, which is now being experimented upon at Shoeburyness. Captain Scott has very clearly pointed out that the great objection to water is, that it checks the recoil too suddenly at first, and that the action of water then becomes gradually diminished, until at the time when it is most wanted it ceases to act altogether. I think the introduction of air in a perfectly air-tight cylinder, such as I suppose these are to be, and which is not a matter of difficulty in practice, is, as a first idea, worthy of all consideration by the authorities. If water has been applied successfully to check the recoil of guns, it is my opinion that air may be applied more successfully to the same purpose, because it better fulfils the conditions which are required than water does. Without entering into the detail of the principles, and of the proportions necessary for that air cylinder to meet the recoil of large guns, I think the design is one which exhibits great ingenuity, and which, if it can be successfully applied, will be likely to produce great and useful practical results. And should such results occur, it will only be one more added to the many instances of useful national inventions, tending to place our country in its present advanced position in regard to artillery, which have been brought forward in this Institution.

The Chairman: I am sure we all feel very much obliged to General Hutchinson, whose unavoidable absence we regret, for having given us this paper. I must concur in the remarks that General Boileau has made, indeed in all the remarks that have fallen from gentlemen; they give a good summary of the subject. It is but fair to say of this plan, that though I and others might criticise the ropes and other details, we should remember that the illustrations are simply sketches and nothing more, intended to convey an idea, which idea would be worked out practically to a good and sound conclusion as soon as we know the forces we have to deal with better than we do now. For instance, I would not take that rough sketch as a representation of what the invention is likely to come to hereafter, any more than I would take that sketch of a human figure as a representative and model of the beauty of a sailor. Still it serves to convey to our eyes the idea of a sailor. So this sketch gives us an idea of what the invention may be hereafter. The idea is the thing we have to deal with now, the practical working out is to be done by-and-bye. There are difficulties no doubt to be encountered, but I believe those difficulties will be got over by the talent of mechanicians in this country. We are very much obliged to General Hutchinson for his paper, and we are equally obliged to Captain Scott for the way in which he has read it. I have now the pleasure to introduce to you Mr. Stone, of the 77th Regiment, who will exhibit models illustrative of his new gun platform.

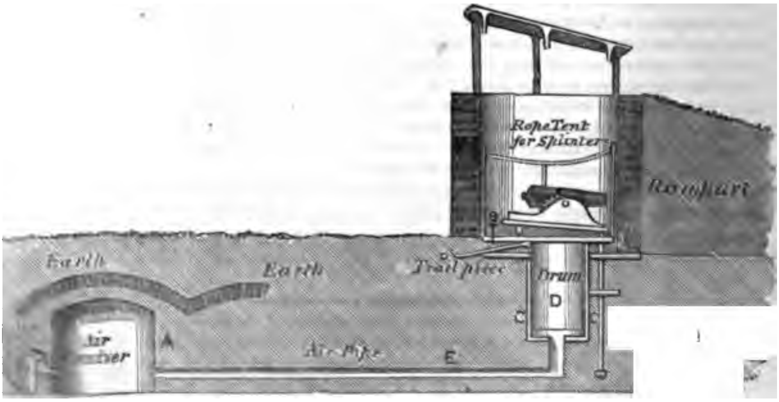
EXPLANATION AND DESCRIPTION OF AN ELEVATING GUN-PLATFORM.

By Lieutenant Cecil Percival Stone, 77th Regiment.

This invention is especially intended to be applied to masonry cylinders, or gun wells, placed at due intervals along the ramparts of fortifications, or in any other situation where a gun may be required to fire through an embrasure, or "*en barbette*," and to be lowered after each discharge, or not, as may be found necessary for its safety, or permitted to remain elevated should there be no pressing emergency for sending it below.

The cylinders, or gun wells, are fitted with platforms, which, with the gun, are worked upwards and downwards, and they are covered with a cap constructed of iron plating, supported on iron stanchions let into the masonry, as a protection against vertical fire; the space it covers is soon enclosed, and will permit shot driven by direct fire to pass freely through it; in fact, this cap covering is intended only to prevent shells from lobbing down the interior. The platform and gun are further protected from falling splinters by a tent-like covering of thick rope matting, which it carries up and down with itself.

A rifle-proof mantlet, or blind, working upwards from the rampart towards the capsill of the masonry cylinder, in the manner of a sluice-door, is also employed to enable the platform to be raised to firing height, and the gun laid without being seen by the enemy up to the moment of discharging its fire, and thus keeping them in ignorance whether the gun is elevated or not, and therefore in uncertainty when to fire.



The method of working the platform will be understood by reference to the diagram. A is a large receiver for condensed air, made somewhat similar to a gas-meter, and buried or placed in a masonry vault, so deep under ground as to secure it from vertical fire; the surrounding rampart, as well as its buried position, places it beyond the reach of any other shot or shell.

The receiver may be of any shape—the circular is preferred—and it may be from 10 to 12 feet in diameter, according to the capabilities of supplying it with air, or the number of guns to be manœuvred by it. The air may either be supplied by wind, water, steam, or hand power. Steam power would be the most compact, and easily managed. A small portable engine of three or four-horse power would suffice to fill a receiver to work a battery of as many as ten guns.

Branching from the receiver, in the direction of the platforms they affect, are a series of wrought-iron pipes, E, of 2½ or 3 inches in diameter to convey the condensed air from the receiver into the lift, at the discretion of the gunner on the platform, who regulates its outlet or inlet by means of the handle, B, which, when turned in one direction, lifts the platform, and turned in the other, depresses it. He can also arrest the rise of the gun at any height between its lowest and highest points, an arrangement which offers a great advantage, as securing the gun from exposure in the event of the parapet being lowered by the crumbling effect of the enemy's shot. Each of the pipes has a separate action, and thus each gun, in its working, is independent of the others.

The cylinder, C, is a tube of wrought iron, bored out of a length proportionate to the height through which the gun platform is to be elevated; into this cylinder, C, a drum, D, is fitted, which consists of two concentric circles of plate-iron, strengthened with radiating rods and angle irons. When the handle, B, is turned to open the inlet valve, the condensed air, rushing along the pipe, acts on the drum, D, and raises the platform, with its superimposed gun and carriage; by turning the handle in the opposite direction, the outlet valve is opened, and the air escaping thereby, allows the platform and its load to descend. Air condensed to a pressure of four atmospheres will be found ample for the purposes required. A second handle may be attached to the platform, and made available, on the same principle, for traversing the gun through any horizontal angle, as the first-mentioned handle is for elevating and lowering the platform. A single gunner on the platform can train his gun from right to left, and *vice versâ*, with all the precision of a micrometer screw.

The advantages claimed for this invention are:—1st, that it can be equally made available for a gun to fire *en barbette*, or through a casemate; 2nd, it is capable of adjustment to the accidental height of the parapet; 3rd, all the working gear of the platform can be made absolutely safe from the effects of every description of fire, and the gun is separable at will from the platform; and 4th, the design effects a great saving in manual labour.

The cost of the whole machinery for one gun and platform is estimated at about one-half that of one of our newly-constructed gun shields, while if two or more guns be used, the relative cost for gearing of each will not be much over £300.

The Chairman: It is not quite fair, perhaps, that a gentleman who is not in the army should make remarks upon military questions of this sort; and if I say a few words it is only to suggest points that strike me as difficulties, which, perhaps, Mr. Stone will allude to in his reply. I do not see how the gun in the turret is to be loaded when it is down below. Loading above would, of course, be dangerous from exposure to the enemy's fire; but I do not quite see how you can load below, unless with rope sponges as at present. Again, with regard to the effect of shell, I think a shell going into that turret would have rather more effect than seems to strike Mr. Stone. It seems to me that it would not only damage the gun itself, but that it would damage the cylinder underneath it, and thereby silence the gun. There are one or two other points that occur to me, but I have not the least doubt that my military friends will take them up. I am not myself capable of criticising a military question, so I do not like to say much.

Major-General Boileau, F.R.S.: It is hardly possible, from a mere section of this kind, to come to a right apprehension of what the system is; and as Mr. Stone proposes, with the permission of the Council of the Institution, to give us another paper upon his system of fortification, I would not wish to make any observations upon that at present. The details are too imperfect for a complete apprehension of the system to be formed; it would be doing an injustice to the system itself—indeed, to any system which is intended to produce great results—to express an opinion upon a portion only of that which, I trust, hereafter to see brought before us in a more complete form. In regard to the question of turrets, there is no doubt that turrets are becoming now more generally employed in place of embrasures, for reasons which are patent to everybody who understands anything about defensive operations. I must confess that, at first sight, I do not like that turret. I think it has objections which are of a very grave character. In the first place, being immovable, the gun being in a fixed position, it would be quite possible for artillerists outside to obtain such a perfect aim that the gun would not show itself half a dozen times before it would be knocked to pieces. If it were like other guns of the same system, turret guns, or pit guns, or guns behind solid earthen ramparts, then the gun would pop up at one time in one place, and at another time in another. Such a gun is, so to speak, an artful dodger; and no artilleryman outside would be able to lay his piece mechanically so as to be certain to hit Jack when he popped up next time. But when the gun is fixed, as in this case, and exposes a considerable surface to fire at, I think it is very probable that the gun would be destroyed. There is another point with regard to that turret which I do not like. I think the apparatus for raising the gun is very complicated, it will be very expensive, and very liable to get out of order. We have seen in the small model the imperfection of air cylinders, and I think any such apparatus, which is of such intense importance, which is the soul of the system, which has to elevate the gun when it is required to be fired, is, in principle, incomplete. I believe that the principle of turret or pit guns is the principle that will be introduced almost to the entire exclusion of others. Still, I think we have in the pit gun and balanced carriage of Captain Moncrieff something which is inexpressibly superior to anything that has hitherto been produced. Instead of having to compress air into a chamber for the purpose of elevating a gun, all you have to do is to fire the gun; it is depressed of itself; you merely release a paul, and the gun comes up by a counterpoise weight. There can be nothing more simple in mechanical appliances than the application of the lever principle. Captain Moncrieff's gun is on the lever principle. In all other respects it is the same as this gun, with this great additional advantage that you have no outside appliances, nothing which does not act of itself. I hope by-and-by, when the subject is brought before the Institution, being myself a mechanician, to be able to say something on the points which belong to this system. In saying what I have said to-night, I speak merely upon principles, and upon those mechanical arrangements which have been produced to carry out a great object. I must say that, to my apprehension, although the principle of the turret is the one which will command as well the respect as the favour of all engineers who are engaged in fortification. I do not think, as far as I can judge at present, that this is the mechanism which, hereafter, we shall feel inclined to introduce.

The Chairman: I am sure we must all feel very much indebted to the gentlemen who have given us this information, because although we may not agree in all the details, yet there is a great deal to be learned even by agitating these subjects. We often learn a great deal from the discussion of that which we do not agree with, because we find out from it what we shall agree with hereafter. I shall be very happy, indeed, to hear Mr. Stone on a future occasion, and to learn more from him on this subject. At any rate, we are very much indebted to him for the share he has contributed to this evening's discussion.

LECTURE.

Friday, February 26th, 1869.

W. STIRLING LACON, Esq., in the Chair.

REFORMS IN ARMY ADMINISTRATION.

By E. B. de Fonblanque, Esq., Deputy Commissary-General.

It is only of very recent years that military matters of any description have afforded subject for much enquiry or discussion among the general public. If you refer to the different organs of the press during the twenty years preceding the last war with Russia, you will be surprised to find how rarely the interior economy of the Army became the subject of comment, or was even remotely alluded to, and how yet more rarely this subject was specially treated in distinct publications. Flogging in the Army, now happily abolished, furnished occasionally the material for a sensational newspaper article, and Cobbett in his *Political Register* wrote a series of papers on this subject, for which he was prosecuted and imprisoned for libel, and both in the press and in Parliament, reduction of army expenditure and of military establishments formed a favourite topic for popular writers and speakers, but the great questions involved in the art and science of war, and those not less important questions relating to the moral and physical condition of the soldier, seemed to possess no interest for the public, and even in the Army itself met with little attention beyond the sphere of those immediately concerned in the matter.

I need not tell you how, within a few years, all this has been changed, or how incalculably this change has improved the status of the soldier and with it the efficiency of the Army. It is not alone in military science that within the last dozen years we have made great strides; there is nothing relating directly or indirectly to the soldier that has not become the subject of study and practical investigation, and the result is that he is better armed, better trained, better housed, clothed, fed, and instructed than he has ever been before, and I think I may say better than is the soldier of any other Army in the world; his health is guarded by the highest appliances of sanitary science, his treatment when sick leaves nothing to be desired; he is afforded every facility for intellectual improvement and mechanical instruction, and the State even provides him with the means of recreation and amusement for his leisure hours to an extent which but a short time ago would have been scouted as ridiculous, if not mischievous. Remembering as I do, as I am sure many of my audience do, what used to be the actual condition of a married soldier in barracks, I never see what it is now, I never notice how much has been done to make the home of the married soldier decent and respectable, without feeling struck by the radical change in public opinion which must have taken place to produce such a result. Much, it is true remains to be done before we can make the common soldier what I for one should wish to see him—the intelligent, thinking member of a noble profession—working as every man should work, with the hope of raising himself by his merit and exertions; but we have accomplished so much towards teaching the soldier to respect himself, that I do not despair of living to see military reforms gradually carried so much farther, that the Army will become not only a popular but profitable career for all classes of the community.

I should be at a loss to account for the apathy which up to a recent period prevailed with respect to military matters, and to the general indifference to the grievances of our troops. Probably the change is but the natural result of that enlarged sympathy for our fellow men of all classes, which appears to me a characteristic of the present age. I think we are now more willing to make sacrifices for the alleviation of the sufferings of others, and to take up the cause of the oppressed or injured than formerly, and that for one Howard or one Mrs. Fry that a past generation could show, there are now hundreds of amateur philanthropists battling in the cause of humanity and justice. It would be strange if the rank and file of our Army did not share in the influence of such extended sympathy, and the satisfaction with which every step in that direction has been accepted by our military authorities, is the best proof that it was only the want of support and encouragement from without, that has deferred so long the various recent improvements in the material condition of our troops.

Wholesome and beneficial as such pressure from without must always be, the military force is so peculiarly constituted that the public at large, though it gives the impulse and provides the means, cannot with advantage apply the remedy. No change can be effected in the internal economy of the Army which does not involve considerations of a technical or professional nature; and it is for administration to direct into the most useful and practical channels, the stream of public sympathy or private benevolence.

And this brings me at once to my subject—what is administration? You will pardon me if I here quote a personal experience on this subject. Some ten years ago when Lord Panmure employed me to prepare a work on the "Organization of the Army," and the departments of Supply and Finance connected with it, and I had completed my task and called my work a "Treatise on Army Administration," more than one well-informed man asked me what I meant by "Army administration?" You will smile at this, for the term has now become familiar among us, but

I assure you that in the year 1858, it puzzled a good many people both in and out of the Army. Some insisted upon connecting it with martial law, and one Officer, I remember, enquired whether it was not a new department to be formed at the Horse Guards.

The French use the term "*administration*" to express what we generally call "management." The board of directors of a commercial company for instance is called "*administration*," and the chairman of the board the "*Chef d'administration.*" "*Administration militaire*," however means in France very much what it does with us—it is used to express those functions connected with the Army which are not of a purely military or combatant nature, and when I use the term it must be taken to comprise the entire province connected with the Secretary of State for War with exception of the Horse Guards, in other words all non-combatant services as distinguished from the fighting element.

Now let us look back some fourteen years, and see how the Army was administered before a War Minister was created? In those days the Commander-in-Chief was under the Sovereign, the Generalissimo of infantry and cavalry. The Master General of the Ordnance directed Artillery and Engineers, and was also the Chief of the Civil Departments connected with the supply of warlike stores and the maintenance of barracks. The Secretary at War was the administrator of moneys voted for Army services, and directly responsible to Parliament; he exercised the constitutional check upon military expenditure, and, though purely a civilian, in the event of the office of Commander-in-Chief lapsing, he succeeded to that post for the time being.[*] The Commissariat, which was charged with the supply of money and provisions, was directed by the Treasury; the Militia was under the control of the Home Office, and the Colonial Secretary was also Secretary of State for War, or rather the Secretary of State for War had become charged with the duties of the Colonies, which before 1800 devolved on the Home Office.

We now hear a good deal said about the present so-called double government of our Army, and the danger which might arise from a possible antagonism between a Secretary of State charged with administration and a Commander-in-Chief charged with discipline, but what is such a system compared with that which preceded it? Six independent departments, each of which had to be, or ought to have been, consulted in every detail of military arrangement? The present state of things may have its defects, but it must be admitted that it is an enormous improvement upon that which went before. I have heard persons, for whose opinions I have great respect, advocate a return to the system I have described; but it had a fair trial, and fairly broke down before the first show of war in the Crimea, and there can be no question but that the remedy adopted was, if not completely effectual, at any rate the first step in a right direction. Our administration collapsed in

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[*] It is not generally known that under such circumstances—if I remember rightly it was after the death of the Duke of York—that Lord Palmerston became, and actually was for some time, Commander-in-Chief of the Army.—E. B. de F.

rimea, and this failure was so clearly traceable to the want of
ntrated responsibility, that the appointment of a Minister of War
the supreme authority over the affairs of the Army, suggested
as the natural solution of our difficulties. The country was indig-
at the sufferings to which our troops had been subjected by the
of a system of administration, and this indignation was all the
ter since it could only vent itself upon shadows. “Whom shall
ang?” was the cry, but each chief department of State, Horse
ds, War Office, Ordnance, and Treasury, and each of their subordi-
agents out of doors, could safely shift their responsibility, and
followed those squabbles and recriminations—that series of trian-
duels which culminated in the scandal of the Chelsea Commission.
creation of a War Minister at once fixed responsibility without a
ole for escape. He was invested with great powers; he might
ate his responsibility as he pleased, make what appointments he
e, but for the result, he, and he alone, was answerable to Parlia-
and to the country. Such an office has long existed in other
tries, but under our Constitutional Government there is a difficulty
h does not prevail elsewhere. In France, for instance, the Minister
ar is always a distinguished soldier, trained in military habits, and
ersant with every detail of discipline and administration. He rules
me over the Army under the authority only of the sovereign, and
once chief commander and chief administrator. With us the case
cessarily very different. We select a War Minister not for his
ry experience, but on political grounds; and though the industry and
cation to business which, as a rule, distinguish our statesmen, and
e them during their term of office to study and master profes-
l questions, it is, as you know, a difficult matter for a civilian to
re a knowledge of the technicalities and economy of an army, and
natural result he is compelled to rely upon others for the conduct
ny of his most important duties. There can be no question that,
r as military considerations are concerned, the foreign system
great advantages over our own, and if we lived under a despotic
rnment and could resort to conscription, and spend as much money
e pleased upon the Army without let or hindrance, we might
bly attain greater efficiency and a more powerful Army. But
are not many Englishmen who would purchase such advantages
ch a price, and although I will not go so far as Earl Grey, who
s that every beneficial reform in the Army was caused by civilians
position to military authorities, yet I am not sure but that the fre-
infusion of new and unprofessional ideas into our Army adminis-
n may not, upon the whole, be beneficial. “New brooms,” it is said,
ep clean,” and if our War Ministers have not always been men of
s or originality, they have certainly gone to their work with a good
nd a firm determination to master the difficulties of their position,
do good service to the Army. Let any one of us place himself in
osition of a lawyer, or a young peer, or a country gentleman sud-
called upon to preside over a department like the War Office, and to
e responsible to Parliament not only for the honour of the British
ll the world over—not only for the efficiency, the health, the

comfort, and the discipline of our soldiers—not only for the prudent and economical outlay of the public money—but for every detail of military duty from the strict and impartial administration of justice according to the letter and spirit of the law down to the latest inventions in cooking-pots or knapsacks, or the grievances of Corporal Smith and Private Jones. Let us, I say, place ourselves in such a position, and remember how in Parliament and in the Press questions are put, and criticism is freely indulged in on all such subjects, and we shall probably feel disposed to become very indulgent to the occasional shortcomings of the War Office, and perhaps wonder less at the mistakes that are sometimes made, than that things work as smoothly as they do. A French Officer once said to me: "*C'est bien drôle;* your Minister of War is a man of peace. Your administration is unintelligible; you buy your soldiers and you sell your commissions; *et cependant votre armée est magnifique.*" There is some truth in this. If by Army be meant "soldiers," it is an anomaly to have a civilian at the head of the Army. Our administrative services were until lately, in a terrible muddle; our recruiting system, though now improving, is still clumsy, expensive, and not quite creditable; and promotion by purchase cannot be defended in principle, whatever may be said in favour of its practical results. Still, in spite of all, we have an admirable Army that, as far as the fighting element goes, can well bear comparison with any other, and it behoves every well-wisher of the service to do all that in him lies to place the auxiliary departments—those departments without whose aid neither the genius of generals, the devotion of officers, nor the valour of soldiers can avail—upon such a footing as will develop to the fullest extent the resources of administration, and thereby increase the comfort of the individual soldier and the efficiency of the military body. I believe that free discussion tends to facilitate such a result.

Although both recruiting and promotion are subjects which fall within the province of the Administrator, in the sense in which I use the word, I shall not venture upon this ground, but confine myself to treating of those departments of supply which, under the salutary reforms now in progress, will come under the immediate influence of the Control system.

As I said before, the Crimean war made it evident that our administrative machinery (if so comprehensive a term can be applied to the disjointed makeshifts and poor contrivances called in those days system) was out of gear, and as little conducive to economy as t military efficiency; but, although some fourteen years have passe since then, it is only within the last year that any practical steps hav been taken towards following up the reform which was inaugurated b the creation of a War Ministry. When all the great departments o the State which were concerned in Army administration were amalgamated and brought under one supreme authority—when the offices o Master General and Secretary at War were abolished, and the Colonia Office and Treasury transferred their military functions to the Wa Office—the subordinate agents of these departments out of doors shoul in like manner have been subjected to a corresponding amalgamation o reduction. For some years after the conclusion of the War however, we made the great mistake of repairing and patching, and propping up and adding to the old worn-out, tumble-down fabric, instead of setting to work to demolish, and out of such of its materials as were still of use, with the addition of fresh bricks and mortar and new timber, to build up a sound edifice upon a new and solid foundation. The old departments had been tried and found wanting in strength and cohesion—there was no link connecting them; there was no central authority directing them; and, instead of a common and combined action to a common end, there were jealousy, and antagonism, and irresponsibility, each agency working more or less blindly in its own groove, with its own tools, and for its own object. During the first disastrous winter campaign in the Crimea, nearly the whole burden of army supply fell upon, or rather drifted into the Commissariat; but while this department found itself charged with an enormous responsibility and labour, its numbers, its organization, and its powers, remained for all practical purposes unchanged. The Commissariat had to provide money, provisions, and fuel; the Commissariat became charged with the supply of clothing and camp equipage; the Commissariat had to provide transport by land and water for every imaginable service, and to find expedients to meet every possible emergency. As well might you have expected a Thames steamboat to cross the Atlantic as that the ordinary machinery of a garrison should bear the strain of such a war. To feed an Army in a country devoid of all resources, to carry impossible loads over impassable roads, to work against physical elements, and moral elements yet more unfriendly, to be exposed to the odium of every failure, and to share in the praise and honour of no success, such was the lot of this underhanded and overworked department. After a manful struggle, it broke down under the burden, and became a safe and convenient object for public indignation to vent itself upon. Then followed a gush of extravagance. Money and men were voted without stint; a feast succeeded to the famine, and an unnatural plethora to a state of inanition. In January, 1854, the Army Transport was under the Commissariat, and one junior Officer assisted by a rabble of native overseers and drivers, had the sole direction of this important service. In the April following, a Colonel on the Staff was placed at the head of the transport, and the number of Officers under his orders exceeded that of the entire Commissariat Department. These Officers held military rank, were invested with the authority of Captains and Colonels, and had under their command a small Army of enlisted English soldiers. This was undoubtedly a great improvement on what had gone before, but it was the first step in a wrong direction, since it produced a separation of supply and transport duties; the Commissariat Officer responsible for feeding the soldier being thus rendered dependent upon the Transport Officer for the means of carrying his supplies, and the Transport Officer being made the judge of the quantity and description of transport necessary for this duty. The impracticability of working under such a system of divided responsibility soon became apparent, and was subsequently confirmed by our experience in the campaigns of New

Zealand and China. Failing as it did, however, in practice, it was reserved for Lord Strathnairn's Committee to lay down the principle that no matter what the agency be called, the Officer responsible for the duty of supply must be entrusted with the control of Transport.

On the conclusion of the war with Russia, when there was time calmly and deliberately to survey past experiences, and to remedy defects, I think we lost sight of the true source of failure, and instead of attempting to create one comprehensive administrative system under one directing authority, we set to work to strengthen and consolidate a number of independent departments. The Commissariat had not been permitted to bring with them to the Crimea the Transport which they had been at great pains to collect in Bulgaria, and subsequently they were denied sufficient means of naval transport to draw upon the depôt at Varna. The Transport collected at the theatre of war did not survive the hardships of the first winter, so it was ruled that, the Commissariat Transport having broken down, a new Transport Corps, organized upon a military footing, and independent, not only of the supply departments, but of all direct War Office authority, should be created in its place. Insufficient provision had been made for the sick and wounded, therefore a new department unconnected with that which provided for the healthy troops, was created. At the present moment this department, which administers only to the sick, and does not comprise anything in the form of medical attendance, actually exceeds in the number of Officers and subordinates on home service, the members of the Commissariat, which provides for all the wants of the effective troops; the cost of the latter being only £1,000 a year more than that of the former. As the proportion of sick to healthy soldiers in *the field*, would be very much greater than in this country, think what the Purveyor's draft would become in time of war if the existing system were allowed to continue in force? The Commissariat was reconstituted upon its original basis, and what had formerly been the civil branch of the Ordnance was formed into a large department, on the model of the Commissariat. In the meantime each of these departments required a representative branch at the War Office, and so the number of clerks rose in time to, I think, 650, under no less than nine heads of departments.

Now I am not in the least disposed to join in the outcry against the *employés* in public offices. The languid over-dressed clerk who declined the offer of a cup of coffee at breakfast, on the plea that it would prevent him from sleeping a wink all day, is a creation of Punch's vivid fancy; and the popular belief that the public servants in Pall Mall and Whitehall, do nothing but read the papers and eat sandwiches, is like many other popular beliefs, utterly fallacious. So far from idleness being their fault, I am rather disposed to complain of their excessive industry; 500 educated gentlemen in the full vigour of life, are not likely to pass six hours a day under one roof with their hands folded,

"For Satan finds some mischief still
For idle hands to do."

Work becomes a necessity to them, and if not provided for them, they will make it for themselves, and for others, and that I take it, is one of the great faults of our public offices.

A story is told of a Treasury Secretary, who was waited upon by the inventor of a copying-machine, by the use of which it was alleged, the clerical labour of the office would be immensely reduced. The official listened patiently to the patentee, admitted the value of the invention, but regretted that he could not recommend its introduction in his office, for said he, if we had a machine to copy letters, what would become of the clerks?

I am afraid it too frequently happens that we make work to employ clerks, rather than employ clerks to do work, and I am sure that the first step towards diminishing labour, is to reduce establishments.

Another fault in our public offices, and more especially in the War Office, is the waste of superior material upon inferior duties. Why do we employ highly educated men—many of whom have passed with honour through our public schools and universities, and are capable of filling high positions—in copying letters, endorsing vouchers, and totting up columns of figures—work which would be as well, if not better performed by an inferior class of men? A certain proportion of well-paid, educated, and confidential *employés* is necessary in every public department of the State, but as in the Army there are a few Officers, and a large number of Privates—so in a public office there should be rank and file under a limited number of officers. In the War Office we have only Officers, many of whom do the work of privates. The employment of soldier clerks for purely clerical duties has been tried to some extent with, I believe, great success, and I hope to see the experiment carried much further—not only in the interests of the public—not only to reduce the heavy cost of our establishments—but also to provide a suitable career for deserving soldiers, and thus to encourage a good class of men to enter the Army, not as a temporary refuge from distress, but with a view of qualifying themselves by a course of good and honourable military service, for a comfortable position in after-life. If, as I believe it certainly will, such a system as I recommend should provide a better training, and a more suitable occupation for superior *employés*, should greatly diminish expense, and further prove the means of attracting a higher class of recruits into the Army, it is surely worth trying on a greatly extended scale, of which experience has completely justified the experiment in India, where the employment of discharged soldiers in civil capacities is conducted under systematic arrangements; in Prussia, where such appointments are the legitimate and recognized rewards of good military service; and latterly in France, where the whole of the Corps of *Gendarmerie*, and of the subordinate clerkships in the War Office, and three-fourths of the clerkships in other departments of the State are conferred upon soldiers qualified for such appointments by good conduct and intelligence. I know from general experience, what admirable clerks, in the proper sense of the word, our soldiers may be made, and if there are not more good clerks in the English Army, it is because sufficient prospects are not held out to induce men to qualify themselves for such pursuits.

But it is not only that under the present system we waste good material on inferior work, but few things are more destructive to intellectual energy than for a man to be employed on work far beneath his capacity. I have great faith in the working power of an educated gentleman; but it is a sheer waste of power to employ him in such drudgery as a less educated man would perform at least as well. Sooner or later he would find his duties uncongenial and irksome; when this time arrives, he has ceased to be a good public servant, and the public has to thank itself, if he should turn out a bad bargain.

In a series of letters which lately appeared in the *Times* and the *Morning Post* upon this subject, it was stated, in a tone which bore the stamp of authority, that many of these men, disgusted with the uncongenial nature of their work, and with the entire hopelessness of better prospects, frequently apply their abilities and acquirements to other pursuits, going home to work, and to their offices, to rest.

In a large department like the War Office, it is peculiarly important that a line should be drawn between secretaries and clerks, between the higher functions of finance and administration, and the mechanical duties of a copyist. I believe that the Control system will tend to establish such a division of labour, that when we have one high Officer with competent power and authority to represent supply, and another to represent finance, instead of the many heads of departments now existing, a corresponding reduction and better classification among subordinates within the War Office will follow as a matter of course.

The true principle of administration, is division of labour, and concentration of responsibility. The actual practice of our War Office has been the reverse of this axiom, for it has gone in the direction of concentrating labour, and dividing responsibility; the principle I have quoted, is the key-stone of the new system in course of introduction.

This system has, in some quarters, been treated as if it were a dangerous revolution in our military institutions; but this is a mistake, it is not even a novel experiment.

Not only does it exist, with few unimportant differences, in almost every Continental army, it has also existed in our own service.

More than a hundred years ago, in 1751, Prince Ferdinand of Brunswick then commanding our Forces in Germany complained in a public despatch of "the failure of the Commissariat, and the faultiness of its internal construction;" the report having been referred to the Treasury, the following minute was the result:—

"My Lords, take into consideration the affairs of the Commissariat in Germany, and are of opinion that Commissaries of Control for inspecting and reporting the true state of the Extraordinaries for the service of the Army are an essential part of the institutions of the Commissariat, and that their activity ought to be enforced and attended to; for which reason, it is resolved to recommend to his Majesty the making of a sufficient number of *Commissaries of Control*, to be confined altogether to their proper branch of business, and not taken from thence to attend the providing of the Army, or the keeping of accounts, unless in case of unavoidable necessity."

General Howard was accordingly appointed Chief of the Department of Control, with pay at the exceptionally high rate of £10 a day, and here we have the first instance in our own military administration of the distinct line being drawn between the duties of supervision and execution. On the conclusion of the Seven Years' War, this machinery, however, was demolished.

During the American War of Independence, Sir Brook Watson was sent out nominally as Commissary-General, but with the powers of a Controller over finance and supply; and although no such office was formally recognized during the wars of the early part of the present century, the Commissary-General of the Duke of Wellington's armies found himself, from the necessities of his position, invested with the functions, if not with the authority of a Controller over all administrative services.

During the long peace which succeeded the fall of Napoleon, military administration in all its branches made not only no progress in this country, but retrograded; and in that dream of an eternal peace in which we had learned to indulge, it was seriously contemplated to abolish even the remnants of the weak and ill-trained departments of supply which yet survived. The Report of the Committee on Army and Ordnance Expenditure, which sat in 1850, affords a curious illustration of the short-sighted policy resulting from the false sense of security into which we had fallen. Sir Charles Trevelyan among others pointed out the danger of such measures, and remonstrated in the following terms:—

"As a necessity may at any time arise for active military preparations "either at home or abroad, it is very desirable that the Government "should have a small number of Commissariat Officers at its disposal in "this country ready to be dispatched to any quarter where their services "may be required; and it must not be forgotten that the Commissariat, "although it is as necessary for the equipment of a force as the medical "branch, or the artillery or engineers, furnishes the only direct means "possessed by the Government for controlling the extra expenditure "which swells to so large an amount on these occasions."

The Committee decided that, as "no training in time of peace "would fit a Commissary for his duties in the field during war," the service had better be abolished. They might as well have argued, that as no training in time of peace could accustom a soldier to be steady under the fire of an enemy, the Army should be disbanded. The reduction was made. In little more than three years after, we were suddenly called to arms. I need not remind you how unprepared we were for the emergency, and how painfully the truth was impressed upon us, that it is only during the calm and leisure of peace, that effective arrangements can be completed for meeting the shock of war. Everything had to be created and organized after the time for action had arrived, and while the troops expected to be fed, housed, equipped, conveyed, and tended in sickness—we were still busy trying to establish a Commissariat, a Transport Corps, a Field Train, and a Medical Staff. The burden of supply duties fell as usual on the Commissariat; but this was now a weak, ill-organized department, which had been hurriedly formed out of the *disjecta membra* of a dozen other services—standing alone and isolated—liked by nobody—helped by nobody—spared by nobody.

I say it in no captious spirit—but I am bound to assert my conviction, that the absence of all sympathy for the Commissariat which was very generally prevalent among military Officers at that time, who seemed to consider it rather an antagonistic than an auxiliary service, added greatly to difficulties and precipitated the failures which ensued. There were, I admit, many exceptions to this, but few Officers in authority with whom I came in contact, were capable of appreciating our difficulties, or of making fair allowance for our shortcomings. I never found it an easy matter to convince them that in helping me, they were helping the troops, and that in refusing to strengthen my hands, they were weakening their own. I might give you many cases to establish this fact, but one will suffice. In the first winter before Sebastopol, the want of fresh meat was one of the greatest causes of complaint on the part of the troops. Biscuit and salted meat were never wanting in division. But biscuit is poor food to support an over-worked soldier, and the salted meat was unpalatable from the difficulty of cooking it properly, and often useless from the want of fuel for cooking it at all. Little or no cattle could be obtained by us in the Crimea, and we had accordingly to import it from the ports on the Black Sea—no difficult task, you will say, as we had complete command of the ocean; but, unfortunately, though the Commissary-General was empowered to hire shipping, the disposal of it rested with the naval authorities, and it frequently happened that our cattle ships were diverted for other purposes, and that the supply thus failed. In December, 1854, we were particularly badly off for fresh meat; with some difficulty, however, I accumulated in Balaclava sufficient cattle to ensure for my division their roast beef on Christmas-day, and on the day before, applied for a fatigue party to bring up the cattle to the front, I having at that time no subordinate establishment of my own, except what I could form by borrowing from regiments. "My soldiers are not cattle-drivers," was the reply I received. I had accordingly to entrust the escort of the Christmas dinner to native drivers. Unfortunately, their road lay through a French camp. Now, our allies possess among their innumerable soldier-like qualities, the very important one of taking remarkably good care of themselves. In this case, their instinct carried them too far, for they appropriated our property; and though they subsequently apologised for the mistake, they did not do so until the cattle had been slaughtered and eaten; and when a day or two later Lord Raglan, who had always a kind word for every one, asked a passing soldier in our camp, whether he had had a good Christmas dinner, the man replied, "nothing but charcoal, sir."

I am quite aware how hard it must have been for a General Officer to have reduced his small overworked army by detaching soldiers for non-military duties, and how natural it is that he should be very chary of the fighting element at his disposal; but fighting and feeding are very nearly connected, and in this, as in other instances, it would have been better to have withdrawn a few men from the trenches for the sake of assisting or supplying the wants of the many in the camp. The great fault, however, I must allow, lay in the defective organization of the supply departments. Badly and insufficiently as these were officered, they had positively no subordinates, but such as could be scraped together in the way I have described—the few civilians attached at that time being utterly unfit for their work, and for the greater part ignorant, ill-conducted, and insubordinate. The formation of departmental corps for the commissariat, the military stores, and the hospital departments has now supplied this deficiency, and we should find in them an invaluable assistance on active service.

Now, in the French Army, although the *Intendance* had, during the Crimean war, a complete and thoroughly organised *corps d'administration* under their orders, the further demands made for military labour were invariably complied with.

When the *Intendant-Général* wished to establish a depôt of supplies at Baidar he made requisition for, and obtained, an entire battalion, who, from the Colonel to the drummer-boy, were placed at his disposal for administrative services, and no one thought this a hardship; for no one in the French Army considers it a joke to see the *Intendance* in trouble, knowing that it is the Army itself that must suffer from such failure.

It is useless now to reflect upon the saving in human suffering, in money, and in prestige which might have been effected, had something like a Control system existed during the Crimean war. Even during its progress, the formation of a central directing power on the spot was urged from various quarters, and subsequently Sir Charles Trevelyan, who during his long and intimate connection with the Commissariat, had thoroughly mastered the principles and the practice of military administration, and the late Mr. Godley, Assistant Under Secretary at the War Office, and one of the ablest and most enlightened and far-seeing officials I have ever had the good fortune to meet, strongly represented the absolute necessity of some such institution. In a memorandum written in 1855, Mr. Godley says—

"It is worthy of consideration whether it may not be found neces-
"sary to attach to the armies in the field and to garrisons, Officers cor-
"responding with the Intendants of the French Army, who may, in
"strict subordination, of course, to the Commander of the Forces, super-
"intend and control the several civil services connected with the Army.
"In the last war, this function was practically in great part discharged
"by the Commissary-General, whose department had the charge of all
"the duties which are now divided, and are likely to be divided, among
"the Storekeeper, the Director of Land Transport, the Commissary-
"General, and the Treasury Accountant. It is more than questionable
"whether the common subordination of these Officers to the Commander
"of the Forces be sufficient to ensure that unity of action and mutual
"co-operation among them which are essential to the success and safety
"of the Army."

In the same year, a Committee of English Officers, under the presidency of Major-General Knollys, drew up an exhaustive report on the French Intendance, from the concluding paragraph of which I would beg to be allowed to make a short quotation:—

"Next, we would point out the admirable organization of what may "be termed the Civil Service of the French armies, by which a General "in command has always at his side a chief of the Civil Staff, having "at his disposal all the means of provision and of transport, and "ready to place before the General a review of the extent to which "those means will reach, so that before undertaking any military "movement, the General may know exactly how far his troops can be "supplied with everything necessary to enable them to command "success.

"And next in connection with this subject, we would point out that "wise division of duties and responsibilities among the various de"partments of the Civil Administration, by which the heads who have "to foresee and provide for the consequences of every military "operation, are relieved from the cares and anxieties attending the "supervision of details; so that an Intendant when studying the "resources of various countries, and calculating the best means of "drawing from each the supplies which it is best calculated to afford, "is not liable to be interrupted by the necessity of issuing rations, or "making payments, or casting up accounts."

In 1858, I ventured to publish my opinion, that none of our administrative reforms would avail until we should introduce that "most essential element, a superintending department, to control and direct all services not of a strictly military nature;" and in 1864, Sir William Power, in his evidence before a War Office Committee, under Lord Hartington, sketched the outline of a department of control which hardly differs in any material respect from that now actually in course of formation. These suggestions were adopted by Earl de Grey, who in 1865, proposed to the Treasury that, "both on account of economy in peace and efficiency in war, the several administrative departments should be brought to a focus," both locally and in the War Office. Lord Hartington, in moving the Army Estimates in 1866, stated that it was the intention of the War Office to appoint a superior class of Officers, to be called Controllers, who should be placed in charge of the administrative departments at each military station;" and he appointed a Committee, under the presidency of Lord Strathnairn (then Sir Hugh Rose), to report upon the subject. I should here perhaps mention, that the original instructions to this Committee were limited to the questions of the organization of Army Transport; but this subject was so inseparably blended with supply generally, and the impracticability of separating the two services and dividing the responsibility attaching to them, was so evident, that General Peel, who had in the meantime succeeded to Office, sanctioned the larger question of a Control system being included in the deliberations of the Commission, who sent in a preliminary report in September, 1866, and in the spring of 1867, presented that full and interesting Report, now so well known, under the name of Lord Strathnairn's Committee, and which forms the foundation of the new Control scheme. In January, 1868, Sir John Pakington gave practical effect to these recommendations by the appointment of a Controller-in-Chief at the War Office, and it remains for the present Secretary of State to crown the work of his predecessors by the formal inauguration of the new system throughout the

Army. The fact that the principles laid down by a committee composed of the distinguished representatives of all branches of the Service should have been adopted by no less than five successive War Ministers, each of whom more or less helped their progress, affords a fair guarantee for the thorough soundness of the proposed reform; from which I, for one, anticipate greater moral and material results than have yet arisen from any change we have made in our system of Army administration since our Army was created, or an administration formed to supply and regulate its wants.

I am inclined to believe that the peculiar organization of our military staff has hitherto had an injurious effect upon the supply services of the Army. In France, as in most other countries of the Continent, the *Etat-Major* represents the purely military, and the *Intendance* the purely administrative services. The former is a distinct corps, for admission to which Officers of all arms qualify by a course of study similar to that pursued at our Staff College. Thus a Colonel, or Major, or Captain of the Staff Corps is posted to a division or brigade, and becomes available for any duty which his General may impose upon him. No man is appointed a Quartermaster-General, or an Adjutant-General, or Military Secretary, or Brigade-Major; he is simply detailed for staff duties, and the senior Staff Officer so detailed becomes *Chef d'Etat-Major*, and distributes the various duties among his subordinates. It may be a reconnaissance or a survey to-day, a matter of discipline to-morrow, and carrying orders the day after. I am inclined to think—though it is a subject upon which I speak with some diffidence—that this system has advantages over our own, and that nothing is gained by dividing the military staff into separate departments, under distinct heads.

In the field the duties of our Staff Officers are perfectly defined, and the Quartermaster-General and Military Secretary have each full employment within the legitimate provinces of their functions; the former in strategical arrangements, in military surveys, reconnaissances, and the movements and camping of troops; the latter as chief of the personal staff and private secretary to his General: but in garrison the case is different, and having nothing else to do, they have come by degrees to assume a kind of supervision or interference in supply and finance duties, which has only the effect of weakening responsibility and increasing correspondence.

Now I don't believe in any system of military administration which is only applicable to times of peace, and is thrown overboard when war breaks out. As soon as an army takes the field, both Quartermaster-General and Military Secretary find that they have quite enough to do without meddling in the affairs of other departments. There are doubtless many now present who took part in the first landing in the Crimea. No sooner did we land than the whole efforts of the Commissariat were directed to hiring or seizing transport; and as the Crimean Tartars showed every disposition to place their services at our disposal, being assured that they would be well paid for, we had within 24 hours a very respectable establishment of ox-arabas and horses collected at Calamita Bay. On the following morning we were ordered to transfer all transport to the Quartermaster-General's Department, and thenceforward we could not obtain a single cart for conveyance or collection of supplies, except by requisition upon the Quartermaster-General, who had not the means of judging of the extent and nature of our wants, and who naturally enough attached greater importance to the more military requirements of the Army than to the carrying of provisions. Now if this department had held itself responsible for the supply of the troops, nothing could have been said against such an arrangement, but every Staff Officer would have utterly repudiated such a responsibility. If all went right his was the credit; if anything went wrong, he was free from blame, and so the Commissariat had to play the losing game, vulgarly called, "Heads you lose; tails I win."

I believe the Quartermaster-General himself was the first to admit that this arrangement placed him in a false position, and a few days later, Lord Raglan ordered that all transport should be placed under the Commissary-General. In like manner the Military Secretary found out that finance was not his vocation, and a Commissariat Officer was specially attached to head-quarters to relieve him of a duty entirely foreign to his position, and for the proper performance of which he could not find either the necessary training or experience.

The introduction of the Control system will remove such anomalies, and by relieving them of extraneous duties, will render Staff Officers generally available for the performance of their legitimate functions in whatever branch they may be required. At present the Commander-in-Chief, and under him Generals commanding divisions and brigades, convey their orders and correspond through these different channels—through the Adjutant-General on discipline, the Quartermaster-General on supply movements, and the Military Secretary on promotion and finance. As supply services are now in course of amalgamation under a Controller, so a corresponding amalgamation of the Staff under one head, would appear to suggest itself as a logical result. Thus a General would have two principal agents and advisers; on his right, the Chief of the Staff for military; on his left, the Controller for administrative services. I do not think it is easy to over-estimate the reduction of correspondence, the simplification of work, and the increased concentration of responsibility which must result from such a change, or the extent to which it would relieve a Commander from a number of harrassing details at a time when his mind should be left most free for maturing his plans and directing his military operations.

I have hitherto spoken of the Control system very generally. I will now place before you, in as concise a form as possible, its details. As I have said, the administrative service of the Army has hitherto been distributed among five distinct departments: the Commissariat for money and provisions; the Military Store Department for munitions of war; the Purveyor's Department for hospital supplies; the Barrack Department for the maintenance and appropriation of military buildings and furniture; and the Military Train for transport. Each of these departments has its chief at the War Office, and its local head at each military station, where there is a Principal Commissariat Officer, a

Principal Store Officer; a Principal Barrackmaster; a Principal Purveyor; and a Principal Transport Officer; each corresponding with the General in local command, through the Quartermaster-General, Adjutant-General, and Military Secretary, and with the War Office, through the central head of the department. Each of these heads worked under distinct regulations, and each was more or less jealous of the attitude assumed by its neighbour, and tenacious of its own dignity and independence; and thus they conscientiously and industriously played the game of cross purposes at the public expense. For the result, it is not they who were to blame.

Now a certain amount of mere formality is necessary in the transaction of public business, and those who point to a large banking establishment or counting-house as an example to Government offices, forget the widely different conditions under which these work. Red-tapeism may be and often is carried to a preposterous length, but a certain amount of red-tape is indispensable for keeping public departments in working order. Nothing has been more unjustly blamed than the thing called routine; for though it may be overstrained, it has been well said, that "routine is to administration, what law is to justice."

Routine, however, should be the servant, not the master, and the revolution which has of late times taken place in the whole system of warfare calls for a thorough revision of the system of administration, and of simplification in the routine which subserves it. Perhaps, the one element which will most distinguish future from past wars, is "rapidity;" rapid concentration, rapid advance, intense energy, decisive action. With the introduction of steam and electricity, the old machinery becomes not only useless, but cumbersome and mischievous. A writer in the *Edinburgh Review* remarks, that the introduction of gunpowder did not cause a greater revolution in warfare than has been created by recent improvements and scientific inventions, and administration in all its branches must keep pace with the giant strides of military science.

In days gone by, it was possible to create, as the Duke of Wellington did create, the essentials of an army, after the troops had actually taken the field and faced the enemy; for the future, hours will be of more importance than months were then. A campaign will be the affair of weeks instead of years; and although the preponderance of numbers must always incline the scale, I venture to believe, that that Army will be the most successful which shall be the first to take the field in the most complete state as regards its equipment, organization, and the entire machinery for expediting its movements, and supplying its wants.

Under the administrative system, which is now in course of reformation, it was not the routine that was in fault but the impossibility of making routine subservient to practical duty, owing to the multiplicity of channels through which it was required to pass. I will give you a case in point which fell under my own observation:—The Commissariat required a weighing-machine, which the Military Store Department held in charge, and addressed a requisition to the Quartermaster-General, who submitted it to the General Officer in command, who having approved it, returned it to the Quartermaster-General, who sent it back to the Commissariat, who forwarded it to the Military Store Officer, who submitted it to the War Office; whence, after travelling among the different heads of departments for ten days, it was returned to the Commissariat Officer, who sent it again to the Military Store Officer, who made a requisition on the Quartermaster-General for a cart to convey it, which requisition the Quartermaster-General sent to the Transport Officer, who provided a four-horse waggon with two drivers and a non-commissioned officer, to carry the machine from the Military Stores to the Commissariat Stores, a distance of 30 yards. I can assure you that this is no exaggerated illustration. Now let us see how this transaction would be conducted to-day. The Commissariat Officer would apply to the Controller, who would refer to his returns, and finding that the article demanded was in store, give the order to the Store Officer to deliver it, at the same time ordering the Transport Officer to have it conveyed by the first empty waggon passing on its way to the Commissariat.

The Controller will in fact represent these five principal heads rolled into one, with direct responsibility to the Controller-in-Chief at the War Office, and to the Officer in local command, whose orders he will receive and promulgate among the Executive Officers under his direction. These officers are—

1st. Three classes of Commissaries for the supply of provisions, of military stores, and of hospital requirements.

2nd. The Transport Corps for all Army purposes.

3rd. Staff Paymasters and Treasurers for raising funds and disbursing, and accounting for military expenditure.

Under the first head are included the existing Commissariat, Military Store, and Purveyor's Departments, minus the two higher ranks in each, which will gradually be abolished; and although each of the three classes of Commissaries will be kept as much as possible to their own peculiar work—the first to the supply of food, the second to the custody of non-consumable stores, and the third to the supply of the sick, they will form one department and be virtually exchangeable and transferable when the necessity may arise for supplementing the deficiencies in one branch from the superfluities in another. At present if there should be ten Officers in the Commissariat over and above what are wanted, and the same number deficient in the Military Store Department, new appointments would have to be made in the latter while the former would remain overhanded. In future all will be available for general supply duties.

Under the Commissariat there will be a departmental corps, comprising the existing Commissariat Staff Corps, Military Store Staff Corps, and Army Hospital Corps, who will in like manner be sectionally divided for their respective duties, but like the Officers be liable to be transferred to one of the other branches should the convenience of the Service require it.

The amalgamation of the three existing corps is now in progress, and one Officer will take the place of the three now charged with the discipline and general direction of the men.

When I stated that the new Commissariat would comprise the Military Store Department, I should have mentioned that the question of bringing the administration of warlike stores under the Controller is still under consideration. At present the Military Store Department is charged with the custody of ordinary stores, such as furniture, implements, camp equipage, &c., and of those stores which the French call *Munitions de Guerre*, comprising arms and ammunition of all kinds. Over the latter the Officers of the Royal Artillery exercise a kind of supervision in their capacity of "Inspectors of Warlike Stores."

Now it would be quite in the natural course of things for a branch of the Commissariat to hold and issue ordinary stores and camp equipage, but I am inclined to think that special knowledge and training are necessary to deal efficiently with guns, shot, and shell, and that, more particularly for the supply of ammunition in the field, a distinct agency is requisite. I should, therefore, be disposed to advocate the formation of a department, to be called Commissariat of Ordnance, to be trained exclusively for this duty, in connection with the Military Manufacturing Departments, and to be organized with a view to maintaining a regular and continuous supply of ammunition on active service, a duty which with the improved weapons now in use, and the consequent largely increased consumption of powder and shot, becomes of such paramount importance. Whether such department should fall under the direction of the Controller or of the Artillery is, I think, a mere matter of official convenience. The Director of Ordnance is as much an administrative Officer of the War Department as the Controller-in-Chief—as much interested in the judicious management of public property, and as responsible to the Secretary of State for economy. The duty partakes, more especially on service, of a military rather than a non-combatant character, and upon the whole I think that this service might with advantage be withdrawn from the jurisdiction of the Control Department. Be this as it may, there can be no doubt that a division of such stores under two departments would be very beneficial, and that the one charged with the supply of warlike stores should be specially trained and organized for this duty.

The Commissaries of Stores then, whom I have included under the new Commissariat, would hold and issue all ordinary stores, and would further be the custodians of the furniture and stores now in possession of Barrackmasters, whose office will be entirely abolished, their administrative duties in connection with general expenditure devolving on the Control Department, in direct communication with the General, and with respect to the assessment of damages and custody and repairs of buildings, on the Royal Engineers.

The Transport Corps will be substituted for the existing Military Train. When I had the honour of addressing you two years ago on the subject of "Commissariat Operations in the Field,"* I referred to the defective organization of the Military Train for the purpose for which it was intended. The fault lay in its being organized on a military footing, commanded by military Officers, and drilled on military principles. It is but natural that it had military tendencies, and came to prefer fighting to carrying, and drill to driving—in short, to be a little above its work. The new corps will be differently composed; it will, in fact, consist of enlisted waggoners, sufficiently drilled for the proper performance of their work in connection with troops, but freed as much as possible from military trappings and equipment—a kind of military "Pickford" Corps. It will be directed by Officers to be called Commissaries, who will make the organization of transport the business of their lives, and it will be under the immediate authority of the Controller. I will not enlarge on the question of Transport, but I am glad to hear that so important a feature in Army administration will before long become the subject of a lecture here by an Officer peculiarly qualified to discuss it.

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* Vide Journal of the Institution, Vol. X., Page 463.—Ed.

The third of the sub-departments is that charged with finance, pay, and account duties, representing the Commissariat Officers now employed on foreign stations as Treasurers and Military Accountants. Great benefit might, in my opinion, be derived from an arrangement under which these Staff Paymasters should be made interchangeable with regimental Paymasters, as a link between general and regimental finance would thus be established, and such a system would bring this branch of the service into more complete harmony with the Army generally, and produce a large economy. Lord Strathnairn's Committee have strongly urged the adoption of such a plan.

I should be disposed to create a similar connection between general and regimental supply duties, by substituting for the existing Quartermaster a kind of regimental Commissary, transferable to the staff when necessary or convenient, and available for duty in any one of the three branches of the Commissariat of Supply.

The Controller has thus the three departments of Supply, Transport, and Finance under his direction; that is to say, he instructs the executive Officers as to the wants of the Service, supervises them in the performance of their duties, and is responsible that they conduct their respective transactions in strict conformity with the regulations established for their guidance; but the Controller's responsibility is moral, not material; he can, under no circumstances be the custodian of or the accountant for either money or stores, nor could he be held responsible for losses arising from neglect on the part of the executive Officers under him, unless he should have failed in that supervision or inspection, for the due exercise of which he is vested with a position of power and authority approaching that of local representation of the Secretary of State.

Here I should however refer to two opposite lines of hostile criticism against the Control scheme, which have appeared in the public prints and been hinted at in Parliament. One argument is, and this comes from military quarters, that the Controller will be apt to assume a position of independence towards the Officer in command, incompatible with military discipline; the other, that in being placed under the orders of a General in local command, the constitutional control over public money and stores will be diverted from its proper channel and exercised by a military Officer instead of by the Secretary of State. Both arguments are utterly untenable. The General Officer on a foreign station is the actual representative of the Secretary of State to whom he is personally responsible for any administrative measures he may initiate, and it is to support him in this responsibility that a Controller is placed under his orders to advise him upon this branch of his duties. A Controller could no more over-ride a General in matters of administration, than an Adjutant-General could over-ride his authority in a matter of discipline. Both of these Officers would be bound in duty, respectfully to warn their chief were he to give an order contrary to regulation; but, should he persist in such order, both would be equally bound to obey it, the responsibility for the consequences resting with the General. The Controller is, however, himself responsible for any unauthorized transaction which the General may sanction upon his recommendation.

To make a Controller independent of the General Officer in command of the troops to whom he is attached, would strike at the root of discipline, neutralize all responsibility, and create a divided authority which would only result in confusion and failure. To make him, on the other hand, only the irresponsible subordinate of the General would destroy his usefulness and the object for which his office is created. It is curious that civilians and soldiers should each apprehend in the Control system encroachment upon their positions, and that while the former have dressed up a bogey called the Horse Guards Plot, to frighten the War Office, military men seem induced to oppose the scheme, lest it should bring too large a preponderance of the War Office element to bear on military affairs, and induce War Office clerks to usurp the command of the Army. I believe that a better acquaintance with the principle of the Control system will remove the objections on both sides, and induce even the *Pall Mall Gazette* to see, if not to admit, the error of its ways.

The element out of which the Control department should be formed, involves questions of considerable importance. Lord Strathnairn's Committee recommend the appointment of picked men of the existing departments, with an infusion of military Officers of all arms; but the necessity for absorbing as far as possible the existing materials, renders the immediate employment of military men a matter of some difficulty on grounds of economy. That such an infusion would be very advantageous, I cannot for a moment doubt; for not only would it tend to introduce harmony between the combatant and non-combatant branches, but the professional knowledge which could be brought to bear upon administration by the employment of men conversant with the details of the different arms of the Service would prove most valuable. The French *Intendance* is now recruited exclusively from Officers of the Staff Corps, not under the rank of Captain, who resign their military position on joining the department; and although I do not think that to exclude civilians would be a wise measure in our Service, I believe that ultimately, and after absorption of the members of existing supply departments, it would be of advantage to give the Control department a more military character than from its present composition it can possess.

The sub-departments will, in like manner, be in the first instance formed from existing departments; should that connecting link to which I have referred be established between the Staff and Regiments, Paymasters and Commissaries would ultimately be drawn from the line, and I believe that were such a prospect held out to deserving and well-qualified non-commissioned Officers, it would tend to attract a very superior class of recruits to our Army, and at the same time furnish an excellent source of supply for the executive supply duties.

I have endeavoured to present to you an outline of the system now in course of introduction, with a view to improving the administration of our Army, a system of which for many years past I have been a persistent, though humble advocate; the progress of which I have watched with deep interest; and of the final success of which at no remote period I feel very confident. Every reform has its enemies, as every abuse has its defenders, and it is not easy to over-estimate the difficulties which had to be met by those to whom it fell to establish the principles, and who became charged with the duty of carrying out the details of such a reform as this. The interests of one class must be protected, the prejudices of another conciliated, the opposition of a third disarmed. Men who have long worked, zealously and faithfully, in one groove, are difficult to convince that their groove is the wrong one; they cannot bring themselves to believe that a system in which they have been trained from youth, under which they had laboured all their lives, can be a faulty one, and they believe conscientiously, that to upset it would be perilous, if not ruinous, to the public interests, which they have at heart. Like Jack Falstaff, they are of opinion that anything else might be abolished, but that to touch them would be fatal.

"No, my good Lord," they say in effect, "banish Peto, banish "Bardolph, banish Poins; but for sweet Jack Falstaff, kind Jack "Falstaff, true Jack Falstaff, valiant Jack Falstaff, and therefore more "valiant, being as he is, old Jack Falstaff, banish not him thy Harry's "Company—banish plump Jack, and banish all the world!"

The steady and conscientious opposition of such men presents a formidable barrier; then there are others whose hostility is less disinterested. Every great change involves some sacrifices, and few men are so patriotic as to be willing to secure the interests of the public at the expense of their own comfort, dignity, and position. The French have a proverb, which lays it down that you cannot possibly make omelettes without breaking eggs; but if eggs were sentient, they would doubtless be selfishness enough to demonstrate the utter uselessness, if not the danger of omelettes.

Then, again, there is a class of people, who from mere timidity, exaggerate all difficulties, and see dangers in every change; and there is that yet larger class, large in every walk of life, but largest perhaps in official life, which from moral indolence or mental short-sightedness, is for what is called, "letting well alone," and which, provided that a thing seems likely to last their time, they prefer not to tamper with. I have found that these people are generally successful in the public service; they are what are called "safe men."

en it is considered how strong these antagonistic elements
the walls of the War Office must be—and in making this
I wish to guard myself against the intention of speaking dis-
ngly of those who honestly and conscientiously oppose all such
es—when we reflect what an enormous resistent power is pre-
, even by the passive opposition, the *vis inertiæ* of office, we may
tulate ourselves upon the progress which has been already made
direction of so beneficial a change, and we cannot fail to appre-
the ability, the tact, and the energy of those to whom this
lt task has been confided, and who have in the course of one
brought their labours to so successful an issue.

Evening Meeting.

Monday, March 15th, 1869.

Admiral Sir HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 15th February and the 15th March, 1869.

LIFE.

Watts, J. S., Navigating Lieut. R.N. 9*l.*
Wilson, A. K., Lieutenant R.N. 9*l.*

ANNUAL.

Montgomery, W. Edward, Lieut. Sco. Fus. Gds. 1*l.*
Teschemaker, T. R., Major (ret. f. p.) Roy. Art. 1*l.*
Fitz-Gerald, J. Penrose, Lieut. N. Cork Rifles. 1*l.*
Jenner, Stephen W., Lieut. Roy. Engrs. 1*l.*
Mist, Henry W., Capt. Roy. Engrs. 1*l.*
Lawrence-Archer, J. H., Captain late 4th W. I. Regt.
Sexton, M. S., Capt. Roy. Art. 1*l.*
Grant, W. B., Captain R.N. 1*l.*
Russell, Charles R. T. Lieut. R.N. 1*l.*
Gimson, Herbert, Navigating Lieut. R.N. 1*l.*

WORKING HEAVY GUNS ON THE BROADSIDE, WITH SOME OBSERVATIONS ON THE ALL-ROUND FIRE, COMBINED WITH THE BROADSIDE SYSTEM OF ARMAMENT.

By Captain Edmund Wilson, R.N.

It is with much pleasure that I read a paper this evening, by permission of the Council of this Institution, on my plan for "working heavy guns on the broadside, present and future, with some observations on the all-round fire, combined with the broadside system of armament."

I will endeavour to make my views on these subjects as clear as possible, so that those unacquainted with the working of heavy guns in all kinds of weather, may comprehend the simple, yet I hope efficient, plan for working them on the broadside under almost any circumstances, and which I have now the honour to bring before you.

If we look back, even to a quarter of a century, what wonderful

If we look back, even to a quarter of a century, what wonderf es have taken place, not only in the armament of our Fleet, but construction! At that period little did we dream of having an lad Fleet, with 12-ton guns on their broadside, yet at this nt moment we have actually a ship carrying 18-ton guns, besides eds of tons of armour.

ho can say then what the gun of the future may be, and whether hall meet with equal success in working it on the broadside as is ed to be the case with the present 12-ton gun? I say supposed, se it has been asserted that, although the present plan of working has many good points, they are not under perfect control in a y sea-way, and they have not a *bonâ fide* pivot.

is reported that the Bellerophon was utterly unable to fire her when she was rolling only 13°, and this partly on account of her open ports admitting so much water, and partly on account of npossibility of running the guns out with the endless chain, n, having a certain amount of slack, threatened, at every lurch the ave, to allow the gun "to take charge."

w, as far as my judgment goes, we already labour under a disadvantage in carrying the 12-ton gun in its present position; and if udience will cast a look at this model they will perceive that the and armour partake, in some degree, of the advantages of the , inasmuch as the weight becomes more centralized, and its guns fire clear of the seas when the guns of the common broadside would be buried; I, therefore, consider that this is the best on for the gun of the future to be carried with ease, and to be d to advantage as a broadside gun, the calibre of which it is sible for us at present to conjecture. The present turret, howcan work the heaviest gun, so that if my plan for working the f the future be adopted, those who advocate the broadside n may still cherish the hope that, as an ocean cruizer, the turret will be inferior in every respect to the broadside type of ship I o, and models of which are now before you.

may not be improper here to observe, that no turret has yet ed the concentrated fire from four 18-ton guns represented by roadside of the "Hercules," the effects of which, if well aimed, , I should say, render it completely *hors de combat*.

r, as the turret, as a sea-going ship, cannot command an all-round becomes a matter for serious consideration what is the best r carrying the gun of the future, so as to make it available to nd a perfect all-round fire, combined with the powerful force of entrated broadside from four 18-ton guns represented in that n in Her Majesty's ship "Hercules."

r, the "Hercules" may be said to possess an all-round fire, but ar from being perfect. For instance, the moving of broadside o fire through recessed ports is, at best, a poor substitute for an nd fire, and the danger in moving these monster guns in a sea must not be overlooked, but for fighting in smooth water ider the armament of the "Hercules" embraces an all-round fire, addition to the movable guns for her recessed ports, she carries 2-ton guns at either extremity, firing on a line with the keel clear of any obstruction, which guns, however, would be quite harmless in rough weather, or even in a moderate sea when steaming head to it.

Now it will be as well to consider, in working the gun of the future on the broadside, whether we cannot introduce an armament for a ship, say 300 feet in length by 64 in breadth, which shall embrace a powerful broadside battery, and combining a perfect all-round fire.

With all due deference to our talented chief constructor, Mr. Reed, I think that if he had built the "Hercules" something after this model (which I by no means say is perfect) the result would have been far more satisfactory, and a considerable expense saved, by adopting the composite system of ship-building combined with my plan for internal armour.

I must premise, however, that the model before you was designed in 1863, with an armament of 24 6-ton guns, since which we have come to 12, and now to 18-ton guns, consequently her former armament is reduced to 12 guns of heavier calibre.

Now an 18-ton gun requires at least 25 feet between each port, and 9 feet head room. On going on board the "Hercules" her battery appeared to me to be very much cramped; her ports, in fact, were only 14 feet 6 inches apart, and the breech of the gun in close proximity to the deck beams. The plan for working these guns appeared to me to be very complicated, and they certainly could not be worked with breechings and tackles, in case of accident to the machinery, like the models before you; while the recessed ports would act as a sort of shoot for conveying shell and other missiles into the battery. The system of pivoting is weak, and exceedingly liable to fracture from the enemy's shot.

I put it to any unprejudiced person here, whether the battery in this model could not mount four 18-ton guns on each side, and three crossing each other from bow and stern, with 25 feet between each gun, and 9 feet head-room, and also possessing the great advantage of the internal armour principle, by placing a 25-ton gun (which, mind you, the turret is now armed with) 6 feet further in-board, and well clear of the seas, which, at the same inclination, would surge the guns of the "Hercules." (Plate VI., Figs. 2 and 3.)

These are points, gentlemen, for your consideration, and it remains with you to express an opinion whether the gun of the future can be carried and worked with ease on the plan I propose, or to decide that it can only be carried in the turret.

My friend, Admiral Key, under whom I have served, and whom, we all know, it is a pleasure to serve under, and to whom I am much indebted for the care and attention he has taken in inspecting my models, is under an impression that my plan for working heavy guns on the broadside is not adapted to the present system of pivoting in the centre of the port, as it precludes the use of the hollow pivot, through which the chain breeching passes, as shown in my model No. 2, and necessitates the port being made larger on the outside.

Now, the only advantage I can see in the centre pivot is, that it gives
dditional amount of lateral training, and having a com-
port outside, but showing a very broad one inside.

Now, the narrowness of the port outside is very deceptive, so far as concerns the gun and its crew, in affording them protection—for a shot would be sure to penetrate the side which is so much cut away in the beveling, causing innumerable splinters of iron, killing or wounding the whole of the gun's crew, and probably upsetting its complicated machinery.

The pivot, as I previously mentioned, has its weak points also. If a shot should strike the side just below the cill of the port, the only protection the pivot has, is the armour and part of the backing; this, the gun of the present day would be certain to knock away with a single shot, whereas with my pivot the shot must pass through the whole of the ship's side, and then receive a very hard blow itself before it could be damaged.

Now, although my port shows a larger opening on the outside, the inner side is considerably smaller than the port I have just mentioned, consequently I do not cut away near so much of the ship's frame, as the bevel is reversed. My plan, too, for closing the port as the gun fires, completely protects the crew from rifle balls or grape shot, which, to my mind, is of paramount importance when engaging an enemy, who is sure to be provided with the best rifle marksmen. It is a well-known fact that in many instances during the late American war the gunners could not load their guns at a moderate range without being picked off by rifle bullets. My port is of wood sheathed with iron of sufficient thickness to resist either grape or rifle balls.

Now, should a shot come in through my port (which shot would have struck the thin bevel edge of the narrow port, causing innumerable splinters of iron, etc.), it would probably pass through the port on the opposite side of the ship, killing, perhaps, one or two men, but free from the disastrous effects of iron splinters. As regards the pivot in model No. 2, I think there can be but one opinion, which is most to be depended on under all circumstances.

I hope this explanation will satisfy your minds that the gun of the future can be worked on my plan to far greater advantage than on that of the present broadside gun, the only merit of which plan consists in affording a trifle more lateral training, obtained by a great sacrifice of strength to the frame of the ship; by having a weak pivot; and by exposing the guns even to injuries from iron splinters, while the taking up of the recoil entirely by friction, brings all the strain on the pivot and slide: nor it cannot be expected that the very best compressor can be safely relied on after a certain amount of work, especially when fighting in a rolling sea.

Now, by combining the counterpoise weight with the compressor system (and what compressor can be more simple or powerful than the brake on this windlass), and retiring the gun six feet from the side, I think we shall be able to work a 25-ton gun, or one even of heavier calibre on the broadside. Should anything go wrong with the simple machinery I have adopted, there are tackles and breechings kept at the gun ready to be resorted to, though I apprehend if the present slide and carriage were placed in such a predicament, it would be almost impossible to work even an 18-ton gun with such appliances.

My friend, Admiral Key, remarked that my plan would require a vast amount of extra fittings in the ship. Granted, but then the gun carriage and slide would be denuded of its complicated machinery, leaving the balance of cost of difference of fitting in my favour. If we must have these monster guns, depend on it, no trouble or expense must be spared so as to insure their being under perfect control with the most simple appliances of mechanical power, and fit to contend with the rolling of a ship when fighting her guns on the broad Atlantic.

Having thus suggested for your consideration whether the gun of the future can only be worked with advantage in the turret in preference to the broadside, I will, as briefly as I can, describe to you my plan for working heavy guns in the latter position.

The models which I now bring forward, represent a six, and twelve-ton gun with their carriages and slides. In model No. 2 you will observe that although the working of the gun is similar to that in No. 1, the carriage and slide are different. This plan shows that a counterpoise say of one-sixth the weight of the gun would do the duty of running the gun out, while its recoil would be very gentle, as it has not only to lift the counterpoise of two tons, but to force it through an iron cylinder besides raising a heavy port; I am of opinion, however, that the windlass, with a less counterpoise, as shown in No. 1, is preferable.

Model No. 1 I will now proceed to describe :—

When I say that the artificers of any ship could construct such a gun-carriage, or readily repair it when damaged, I conceive that this is its strongest recommendation, as a gun mounted on an iron carriage and worked by complicated machinery on the same deck, is so liable to be disabled.

I consider this point, therefore, as my first advantage.

2ndly. The gun is perfectly under control in the heaviest weather.

3rdly. A 6-ton gun, or one of heavier calibre, could be worked by three men on the fighting-deck, and four on the deck below it, thus lessening the chance of casualties, with a large reserve to fall back on.

4thly. When firing in a line with the keel, and the ship rolling heavily, the gun could not possibly capsize, or get out of gear, while the present carriage and slide could hardly be trusted under these circumstances.

5thly. These carriages are available for those operations, for which the present carriage and slide are inapplicable.

Having thus described its advantages, I may be permitted to explain severally how these are effected.

1st. With regard to its simplicity. The gun is mounted on a common wooden gun-carriage, of suitable size and strength, but its axletrees and wheels are of iron. The slide is placed vertically, and secured to the ship's side, similar to the rudder fastenings of a ship, a suitable groove is cut through the slide from the outer end to within 15 inches of the pivot, corresponding to the height of the axletrees. The open end of the groove receives the gun-carriage, which is then firmly secured by a movable chock with two screw-bolts.

2ndly. The gun is kept under perfect control.

This is effected by having a small windlass, 2 feet in length, fixed on the lower deck immediately under the pivot; the breeching is of chain, which, passing over the open ring at the breech of the gun in a bight, is passed under the gun, and then through a tube 4½ inches in diameter, to the windlass below. Two turns of the chain is taken round the windlass, it then passes through another tube to the orlop deck; the counterpoise is then attached to the chain breeching, which counterpoise works in an air-tight cylinder. The windlass has a powerful brake attached to it, so that when the gun is fired, its recoil would be taken up partly by the counterpoise, and partly by the brake. When the ship is rolling considerably, a lever working on a pivot at the end of the slide, detaches itself as the gun is fired, and firmly secures it from running out again, while, when run out for firing, it is kept in place by the paul of the windlass and the brake.

3rdly. A 6-ton gun, or one of heavier calibre, could be worked by three men on the fighting deck, and four on the deck below.

This is effected by manning the windlass on the lower deck with four men, whose duty besides heaving the gun out, would be to provide cartridge, shot, and wads. The cartridge-box, conveyed by powder-men from the magazine, is passed up a cap-scuttle, 1 foot in diameter, one on each side of the pivot, and handed to No. 3, who, assisted by No. 2, loads the gun; next the shot (kept in racks just under the scuttles) are whipped up by 1, 2, and 3. The shot is placed in a cylinder, slung to a handle working on a pivot, so that when the cylinder is on a level with the muzzle of the gun, the shot and wad is easily tipped into it and rammed home by 2 and 3. No. 1 looks to his lock and sight, and the gun is ready to fire.

4thly. When firing in a line with the keel, and the ship rolling heavily—

This is effected by securing the inner end of the slide by dropping a bolt into a chock, as in model No. 2; the gun would then recoil along the slide with as much ease and safety as when fired from a level platform.

5thly. These carriages are available for those operations for which the present carriage and slide are inapplicable.

This is done by simply withdrawing the carriage from its slide, when it becomes a common gun-carriage, and is capable of being transferred over a moderately rough road.

I have thus, gentlemen, endeavoured to explain model No. 1 in what I consider its advantages, and which I conceive to be equally applicable to guns of heavier calibre, as shown in model No. 2, the principle of working the gun being precisely similar, although the carriage and slide are different. This has also a very powerful compressor, which you will more readily comprehend than I can describe it on inspection of the model. When this compressor is screwed down, you will observe, that so long as the pivot holds on (and it is a strong one), the gun could not possibly capsize in the heaviest rolling sea when firing in a line with the keel.

Now, as it is generally admitted that ships in future warfare will endeavour to engage each other end on, it appears to me very desirable that the gun-carriage of the future should be constructed with a view, not only to the working of the gun on the broadside to the greatest advantage, but to the ability to fire that gun on a line with the keel with confidence, however deep the ship may be rolling.

I fear I have taxed the patience of my audience, but the working of the heavy gun of the future, and its position, whether in the turret or on the broadside, involves a question of so much importance that I feel I cannot close this paper without some further allusion to the working of heavy broadside guns, present and future.

In the Journal of this Institution, vol. xi., page 67, you will find a paper on the "Working of Heavy Guns on the Broadside," by Andrew A. W. Drew, M.A., from which I extract the following: "Within the "last few months I have had the opportunity of inspecting the three "different methods of working 12-ton guns on the broadside, which "have been adopted for competition in the 'Bellerophon,' but in my "estimation they are all open to the following serious objections:—

"1. They cannot give sufficient command over the guns on the broad-"side in a heavy sea-way to ensure their being worked with efficiency "and safety.

"2. They do not provide for any increase of lateral training beyond "that possessed by all broadside ships, viz., about 30° each way.

"3. They do not afford so great an amount of protection for the "gunners as the ordinary methods, inasmuch as the ports are "larger.

"4. The system of pivoting is weak in two out of three of the "plans, and exceedingly liable to become deranged in action. The "plan adopted by Captain Scott is, no doubt, a good substitute for a "pivot, but I do not think it will be found possible to work 12-ton "guns in a heavy sea without the use of a *bonâ fide* pivot, much "stronger than those in use, and perfectly protected from the chance "of injury, and therefore to be depended upon under all circumstances." These assertions were not contradicted at the discussion.

Again, in Admiral Warden's report, he observes that in going to general quarters on the afternoon of the 26th September, "the main "deck was flooded with water, the water poured in and out of the guns, "two shot rolled overboard out of them, and one was followed by the "cartridge. Two of the guns at different times got the better of the "crew, and banged in and out of the port several times with extreme "violence, and two of the slides were to a certain extent damaged by "it. To have opened all the main-deck ports, judging by the effect "of only opening five, would have been to have washed the men away "from the guns, and consequently they (the guns) would have taken "charge of the deck by getting adrift, but with what consequences it "would be utterly impossible to predict."

Again, speaking of the turret-ship, "The sea might, and probably "would, wash right over the deck of the turret-ship, but the water "could be got rid of, whilst here it is not at all clear that it could be "got rid of, and certainly not so fast as it would accumulate."

These are startling facts, and show that even a 7-inch gun is a most difficult machine to manage in rough weather. How, then, shall we be able to control the monster gun of the future?

Now, it is all very well to test guns, and their carriages at Shoeburyness, but the result of the trial is of very little use theoretically speaking, when brought into actual practice on board ship in a rough sea.

On shore, the carriage and slide, with all its complicated machinery, appears a miracle of invention—the whole affair is like clockwork—the compressors take up the recoil, and the monster gun owns itself fairly mastered by the mechanical power applied to it on dry land, but the old fellow, who now lays subdued, whispers to himself, "stop "till I go on board ship, and then see if I don't play them a trick. "Now don't think you are going to rattle me in and out, and firing "ever so many rounds as you did at Shoeburyness, until my poor "inside was almost a-fire. I tell you I won't stand it, and although "you may squeeze me like as you would a lemon, you will never cure "me of my mad propensities on board ship, when old Boreas gives us "a pipe from his whistle; but if you retire me further inboard, and ease "my movements with a counterpoise, then I promise to behave myself "in all kinds of weather, especially as I shall imbibe no more salt "water, which does not agree with my vitals."

Joking apart, these are questions of importance which I have no doubt will receive attention from some of the gentlemen present during the discussion, and it only remains for me to observe that I have done my best to obviate certain defects in the working of heavy guns on the broadside, by combining a counterpoise with friction for more effectually taking up the recoil.

For instance, I do not see how a gun fitted on my plan could take charge of the deck by getting adrift, even if the men were washed from it, and I have certainly lessened the chance of shipping seas through the port, but should a sea come in, I have only to open the cap-scuttles for handing up powder and shot, to clear the deck of any volume of water, which, finding its way to the pump-well, would soon be discharged by the engines.

Those who have brought forward plans for working heavy guns on the broadside, deserve every praise, but as the gun of the future, and the best method of working it, may still be in their infancy, I think, gentlemen, you will agree with me that any person who proposes a plan whereby these monster guns can be brought under perfect control, deserves a patient investigation of his plan when we come to the discussion on it.

According to the title of my paper, I have still some observations to make on a perfect "all-round fire" in rough weather, "combined with "the broadside system of armament."

Now it is easy enough to command an "all-round fire" in smooth water, as in the case of the "Hercules," which I have already alluded to, but the requirements of a ship-of-war suppose her to be ready to act under any circumstances of wind and weather, and therefore it appears to me to be of the utmost importance that a well-designed plan for a perfect all-round fire, combined with the system of broadside armament, should be taken into serious consideration by the authorities. I beg to refer my audience to the diagrams on the wall, and the models on the table, illustrative of my views on this subject, and which I will explain presently.

The case at present stands thus—shall we continue to build ships like the "Hercules" and "Sultan," with high and weak sides, and having a very imperfect all-round fire, while at the same time their batteries are cramped, and their armour inefficient? Shall we continue to expose our men in this confined battery to the bursting of shells, or to the disastrous effects of innumerable splinters of iron? or shall we boldly do away at once with all this extra top-hamper, so detrimental to the iron clad system?

I unhesitatingly say yes, and try in preference other plans, either these hanging on the wall of the theatre, or represented by models on the table.

What was supposed to have been a perfect "all-round fire," has proved a failure when applied to sea-going ships on the turret principle with low freeboard, and the "Invincible" class have the same defective arrangement in their central batteries, as existed in the "Hercules," while their upper deck batteries are so weakly defended by armour as to be, I should say, quite untenable under a heavy fire, independent of their objectional position in projecting several feet from the side, which can hardly fail to weaken the structure and cause heavy rolling. Thus Coles's all-round fire and that of the Chief Constructor, so far as we know at present, evidently tend to prove they are more or less defective, and that we have yet something to learn ere we can produce a perfect and powerful all-round fire, whose guns would be thoroughly protected, and could be fought with advantage in rough weather.

No doubt Captain Coles can design a vessel which will cross the ocean and possess a powerful all-round fire; but when he comes to a full-rigged ship with heavy masts and yards, the case is very different, and clearly proves that low freeboard, whatever advantages it otherwise may have, is not adapted to a full-rigged ship on the turret principle.

For instance, we will suppose the "Captain," with her machinery damaged, or her screws disabled, has to trust to her canvas, would not the seas, when she heels 12° (which from her want of beam, 53 feet, might reasonably be extended to 15°), wash completely over more than half the deck?

She could not fight her turret to leeward or ahead, on account of her forecastle, nor could she fire a shot to windward, which would harm the hull of a ship.

This, gentlemen, you will perhaps say is an extreme case, nevertheless, it proves what our steam fleet is liable to, and points out the necessity that, in ocean cruizing, our Fleet to be efficient, must be prepared to meet all and every exigency.

As far back as 1837, I first turned my attention to an "all-round fire," and my models and plans have been before successive Boards of Admiralty since that period.

This model is my original idea for an all-round fire, and you will perceive that there is no point of the compass that a gun does not bear on, and at the same time my ship can throw a concentrated broadside of five 12-ton guns.

To the original plan I have added a light spar deck, carrying a single turret, the gun of which is more than 20 feet out of water; a style of armament which would have done good service had the Channel Fleet been actually engaged with an enemy on the occasion referred to by Admiral Yelverton.

This deck plan, No. 1, is another system, by which fourteen 18-ton guns are fought in one battery. You will perceive that I can deliver a concentrated fire from three guns directly ahead or astern within 20 yards (Plate vi, fig. 4). The guns are retired 6 feet from the side, and nearly 70 feet from the extremities, and are 16 feet out of water.

No. 2 is the elevation, and shows the position of the bow-gun of the "Hercules" when pitching in a moderate sea. You will observe that under these circumstances, my bow-guns are at a considerable distance from the water, while that of the "Hercules" would be buried. (Figs. 2 and 3.)

Nos. 3 and 4 (Figs. 6 and 7) represent the midship section, showing by retiring the gun six feet inboard that when the ship rolls 20 degrees the gun could still be fought, whereas in No. 4, which represents the midship section of the "Bellerophon" and "Hercules'" class, it could not.

No. 5 shows the disposition of the sails in a vessel like No. 1 (Fig. 1). You will observe that her principal mast is stepped at about one-third of her length; this admits the middle bow-gun to fire right ahead, and while the mode of rig is powerful in itself, it would require not only fewer hands to handle it than if she were ship-rigged, but her pitching motion would be remarkably easy.

No. 6 represents a double or twin mast; each mast is 2 feet diameter at the heel. You will observe they are secured to each other at the head by the cap and crosstrees, and at intervening spaces by strong iron bands, which admits of the topmast ascending and descending in the usual manner. The object of this double mast is, that if the ship-rig is preferred to that described as No. 5, the middle bow-gun would still fire with the same advantage through the double mast, strong cheeks of iron being secured to the mast in the wake of the port.

The arrangement with regard to her stern-guns and the mizenmast would, of course, be similar.

This description of mast would not be heavier than the tripod.

The advantages I claim for my system for an "all-round fire" are the following:—

1st. The guns which command this "all-round fire" are thoroughly protected with 9-inch armour faced with short lengths of chain, hung vertically, removable at pleasure. (Fig. 5.)

2ndly. The guns are always in place, and therefore free from the objectionable plan employed in the "Hercules" and other ships.

3rdly. The battery comprising this all-round fire, combining with it the broadside system of armament, is so disposed as to relieve the extremities and sides of the hull from the enormous over-hanging weights appertaining to the hull of a ship like the "Hercules" and others; consequently, my plan admits of heavier armour being carried, as well as a heavier armament.

4thly. All the guns being of one calibre and fought on a single deck, the ammunition is more readily supplied, the fighting capacity of the ship is more compact, and the top-hamper of the make-believe frigate dispensed with, and its extraneous weights merged with the heavier armour and armament of the pure iron-clad such as I have described.

Before quitting the subject of an all-round fire, I may be permitted to observe that, as my plan, requiring as it does an increase of beam when combined with the internal armour principle, may draw forth some objections to it, I beg to say that 300 feet × 64 is by no means an excessive breadth for an ocean iron-clad as a full-rigged ship; and when we consider that this increase of breadth is at the water-line, and extends downwards some five or six feet only, we shall find that the broad ship, although displacing rather more water than the narrow flat-floored ship, her transverse section will meet with less resistance when propelled by steam or sail power, owing to the resistance being confined principally at the water surface and some six feet below it; whilst the flat-floored ship carries it down to her very keel some 26 feet, and this full displacement is very detrimental to steam propulsion by the screw. I have, therefore, no hesitation in saying, that if the "Hercules" had my midship section, she would steam or sail a knot faster than she does at present; and, as for rolling, it stands to reason that a long, rising, and hollow floor, with a moderately deep keel, with armour and guns retired six feet, very materially assists in producing a ship with a steady gun platform.

Now, when we know that none of our first-rate iron-clads can carry more than three or four days' fuel at full speed, it becomes a matter for serious consideration.

Petroleum, I fear, as a generator of steam is of too dangerous a character to be entertained, and therefore true economy consists in making our ships thoroughly efficient in sail power, and of such a construction as to be able to carry a great press of canvas at a slight inclination, so as to be able to do battle with the elements, as well as the enemy.

This I have endeavoured to accomplish by combining my plan for internal armour with the composite principle of ship-building, which gives increased buoyancy to the hull; consequently it is able to carry a greater weight of armour, and this armour with the gun battery is so disposed as to ensure not only a perfect all-round fire in rough weather, but its broadside guns could be fought when ships of the present build could not open a port.

Thus, gentlemen, I have touched on some of the advantages appertaining to the system of an all-round fire, and pointed out the defects existing in the "Hercules," and other ships on that head. Doubtless there are other advantages in the system yet in embryo, which neither I nor any one here can foretell.

Scarcely a year passes ere some well-matured plan is considered almost obsolete. For instance, the Moncrieff gun has thrown into the shade our most modern system of fortification, and threatens to upset even our Naval armament, showing that Coles's turret and our broadside guns may, ere long, be only talked of as things of the past, and that inventors, to keep pace with the march of intellect, must be possessed of more than a common stock of brains.

This reminds me, before bringing these observations to a conclusion, that inventors who bring their models and plans before this excellent Institution, are invariably treated with the greatest courtesy and attention; and I am sure that my brother Officers will join with me in returning thanks to the Council and its Secretary, Captain Burgess, for their uniform urbanity in all that concerns their department.

The higher authorities, I fear (and this I say with all due respect), often consider us troublesome fellows, and well they may, considering the multifarious duties they have to attend to. Then why not have a Scientific Board of Officers, retired from the service, who with a slight addition to their half-pay would gladly devote their time in examining into all inventions connected with the Navy. Such an arrangement would cost a mere trifle, about £600 a-year, as the meetings need not be oftener than once a month, or so; while, on the other hand, the Controller's Office would be relieved from a most unpleasant duty.

Here we not only enjoy free discussions, but the results very often lead to other advantages, by bringing our inventions to the notice of the Admiralty when they have any merit in them; and even in the poorest invention there is often some good point capable of being improved on. Doubtless the Controller's Department would be rather thankful than otherwise to any inventor who could give them a helping hand by timely introducing certain improvements during the transition state of our Navy, for we may rest assured that it is not in human nature to suppose that the brains of any single individual are equal to the onerous task of forming an ocean-cruizing Fleet to carry the gun of the future on the broadside, combined with a perfect "all-round" fire in rough weather, as well as to meet all and every requirement which the nation naturally demands for so large an outlay of its money.

I have, I believe, now fulfilled my task. I have endeavoured to make my ideas as comprehensive as possible. I trust I have pointed out certain defects in working the present broadside gun, and brought under your notice my plan for working the gun of the future, and improving its position by retiring it six feet inboard. My observations on the "all-round fire" will, I also hope, meet with your commendation, and while thanking my audience for their company on this occasion, I must yet crave their favour in the discussion which follows, rigidly to examine into the principles here advanced on these points. If I succeed in my views for working the gun of the future and improving its position on the broadside, and in introducing a perfect and powerful "all-round fire," I shall attribute my success to the opportunity this Institution has afforded me of bringing forward my inventions before this meeting; whilst, on the other hand, should my plans not be considered feasible, I shall at least have had the pleasure of hearing them freely discussed.

The CHAIRMAN: Would any gentleman like to speak upon the subject, or to ask any questions with respect to the paper which Captain Wilson has just read? I dare say many of us want information upon some one point or other. For myself, am I to understand that the retired gun, the whole mass of the battery, in short, would be elevated so much higher above the water-line in the one ship than in the other, as represented in those models, and consequently more liable to the momentum of oscillation?

Captain **Wilson**: Yes, her battery would be higher, but her rolling would be less.

The **Chairman**: I see that you have a counterpoise there. Every gun, in short, would require a certain additional weight. Supposing the gun to weigh 5 tons, it would require one ton of counterpoise in addition; so that the gun would not be a 5-ton gun, but a 6-ton gun. That would be an additional weight to carry on the ship.

Captain **Wilson**: Yes, there would be a little extra weight, about half a ton for a 7-ton gun, but the carriage would be of less weight than those in use.

The **Chairman**: There is another point I should like to ask about. I do not quite understand about the chain. Is there a working chain that runs the gun in and out?

Captain **Wilson**: This is the breeching of the gun, and this breeching comes round the windlass below (see Fig. 5), and that runs the gun out (showing). The gun is worked from below.

The **Chairman**: Then it will require two decks to work the gun.

Captain **Wilson**: It will be an advantage. My object is to avoid the exposure of the men by working the gun on the lower deck.

Captain **Jasper Selwyn**, R.N.: I do not know whether I ought to be one of the first to rise: I think probably not. At all events I am sure those who have listened to the remarks that are made from time to time in this Institution, will confess that, whatever my other errors may have been, I do not generally err in dispraise of new ideas, or in finding fault; and if on this occasion I point out certain things which I consider defects, I trust the author of the paper will believe that I do so in the spirit of a brother Officer anxious to help forward his invention. I will remark first, that with regard to the frame of a ship of modern construction, we are under very different conditions from those which would apply to the frame of a ship constructed of wood. With an iron construction it matters nothing how you cut it, or where you cut it, inasmuch as the whole structure is put together homogeneously, and you may place the strength precisely where you require it, or leave it out where you do not require it. Therefore, those arguments which point to certain portions of the frame being cut away do not in any degree apply to iron ships. There is no cutting away; there is a building up in a particular direction in which we require strength. With regard to the pivots which are claimed to be stronger on this structure than on any other, I say that if a shot enter, those who have seen shot fired with modern guns are perfectly well aware that no pivot will stand the effect for a single instant, if it were not for the fact that our ships are so armoured, that we do not contemplate shot entering at all, except as an exception.

Captain **Wilson**: You say no pivot will stand it?

Captain **Selwyn**: I say no pivot can possibly stand, wherever it is placed, if the armour-plate can once be pierced and the shot gets inside the ship: I say it is impossible for any pivot to stand a shot that has been able to get into the ship. Many of our iron-clads are, unfortunately, unable to keep out the shot of the present day. A great many of those now at sea would be perfectly futile if opposed to modern guns. We have made great improvements in armour. As guns have progressed, so has armour progressed; and at last we have devised a structure that will defy some shot, but not all. With regard to the running in and out which Captain Wilson spoke of—

Captain **Wilson**: There is no running in of mine. This shows, merely, running out the gun.

Captain **Selwyn**: Pardon me, in this Institution it is the custom to wait until the speaker has done, and it is more convenient. With interruptions, the thread of argument is often lost. With regard to the running in and out proposed here, it is to be remarked that when you are dealing with an incline—and a ship is always a plane constantly changing its incline by rolling—a counterpoise, which is perfectly practicable and good at one moment, may be utterly impracticable and wrong at another. Secondly, that to apply chains, or any similar apparatus, to communicate the motion of the recoil of a really large gun to weights, is, I am sorry to say, an entire violation of all that we know of engineering. The weight which can be moved in a second of time cannot be moved at all in one-tenth of a second. The chain which will stand perfectly a weight of ten tons hanging from it will certainly require to be one hundred times stronger, in order to stand the strain brought upon it by the sudden recoil of a gun operating over one second of time. It has to lift that counterpoise weight, to set it in motion, and it does so with a tremendous strain upon the chain, which we can only call a jerk, but of which we have never been able to calculate the exact laws. That jerk increases and varies as you continue your fire. The gun gets more heated, the gases expand more freely, the recoil increases in power, and it is no uncommon thing to see guns flying in and out again under such a strain. Therefore, it becomes extremely difficult to apply a suspended counterpoise in this way, where the principle of leverage is not called into play, where the strain is transmitted direct from the gun on recoil to the weight to be lifted. Wherever we introduce the principle of levers, there we introduce also the element of time, the weight to be moved, passing through a larger periphery than the gun recoils, and having also a longer time to move; and we get in there the question of time, which is a most important one in considering strains. That the artificers could repair any of our modern gun-carriages without the appliances which we have not, and cannot have on board ship, steam-hammers and lathes to turn an axle, for instance, or furnaces to cast a truck, or to do anything else that is required for large guns, is an expectation that I am afraid would be found a failure in practice. We cannot expect it to be done. It is only by the use of machinery such as we see in our great factories that we can hope to turn out any of the essential parts of a modern gun-carriage on board ship. To return to those structures of wood which resisted the strains of our former ordnance, but which would be utterly incapable, and which have been proved to be utterly incapable to stand those of modern ordnance, would, I am afraid, be a retrogression and not a progression. With regard to the training of guns, I must point out, as I have pointed out once or twice before in this Institution, that the instant we get a good motive power well into operation, the training of guns becomes a very much less serious question than it is now even supposed to be. The twin screw will train a gun more quickly than any crew can do; the hydraulic propeller will also do the same thing. The training of the guns themselves matters very little indeed, except for the purpose of concentration at short distances, which do not require a very great arc of training. Inasmuch as we do not ordinarily fire in that manner on ships far removed, far ahead, or far astern of us, we do not require that power of training, because we are able to change the direction of the ship, and in this way bring the gun to bear, without losing any of the advantages of the twin screw or the hydraulic propeller. We, therefore, think we secure the object in view better by this means than by either widening the ports or providing, by other means, for a great arc of training. When we add to this the fact, that a great arc of training necessitates one of two things, either that your rigging, as in the case of turret ships, should be nearly absent or be prepared to be shot away, or that you should retire your guns beyond their most effective position, it will be seen that we had better go on with and improve some of our modern ideas than go back to the old system which would have these disadvantages. A port is a weakness in a ship which no one will deny. It is a weakness in a fort and a weakness in a ship; and we can never get rid of it entirely unless by some such plan as Captain Moncrieff has invented for forts, which does away with the necessity of ports altogether. The fighting end-on I confess I have never regarded as being an important part of the duty of future ships. That they may occasionally be called upon to fight end-on, I have no doubt; but it would be the merest folly to throw away the power of the broadside for the sake of pelting your enemy with one or two shots while you are approaching him end-on. Occasionally, no doubt, it will be most useful to have the power in chasing or retreating, if retreating be ever brought into operation. I have said something of the things which

Captain Wilson has failed to do: I shall now proceed to mention some of the things which he has done. This is one of the first proposals I have seen for the making of what I may call internal armour, or "close quarters." It differs from the turret in the fact that it is not movable; that it has a power of fighting both broadsides at once; and it has the immense value that the area of the armour is considerably diminished, and, consequently, the weight to be carried is diminished *pro rata*. The thickness of armour may be greater in such a ship, because the armour is not put so much on the outside of the ship. But there is a most important point of difficulty which I beg Captain Wilson, in his answer, will attend to. We have always found that in the turret system, or anything approaching to it, it is necessary to provide one special armour for the gun and its crew, and another special armour for the ship, in order that she may not be sunk. It is clear that if the hull of the ship be considered as external to the armour, and there be a space there into which water can go, we shall have shot passing through the outside skin, and then striking the internal armour. That will produce a very curious effect, in that no one will be able to see what damage he has done from the outside. He will see that he has pierced a hole through the skin, but he will not know what he has done with the armour plates. But it has this other disadvantage, that I am not clear at all that the floatative power of that vessel, after water is admitted from the outside, will be sufficient to support the extremely heavy weights that remain inside.

Captain Wilson: The space between the outer skin and the internal armour is all filled with cork.

The Chairman: I think it will be more convenient to let Captain Selwyn finish what he has to say.

Captain Selwyn: The provision for rigging seems to me liable very much to the same objection as in turrets, unless it be proposed to diminish the width which the rigging occupies, and, consequently, the support to the masts. As we decrease the spread of our rigging, so we decrease also the support which we give to the masts. I am supposing that the rigging is taken to a point inside the armour line. The idea of a double mast is one which I should be very much afraid of. I have seen the effect of the flash of guns on the cheeks of an embrasure lined with iron; I know what its effect is on a deck covered with iron, and I should be very reluctant to fire a gun between two masts placed closely together outside the port. I think even if the gun was never fired except in the direct line of the keel, there would be a certain amount of danger to those masts, and if it were attempted to train the gun at all I am quite certain it would become serious. Next, as to the question of rolling with a long rising and hollow floor, I have had the honour of commanding one of Symond's best ships, and I do say that I did not find their rolling qualities in the least degree diminished by that fact. I must say that I admired them very much, they were a great progress over what we had had for many years before, in speed and in many weatherly qualities, yet I cannot say that in rolling there was an improvement. And I do say, as regards the idea of a peculiar midship section but the same displacement operating favourably or the reverse, I am afraid that Captain Wilson is at loggerheads with the naval architects, and with the mathematicians of the day. We have learned to our cost that to build short ships with the view of making them handy is to call for more power to drive them, and to call for more power to drive them is to shorten the life of the driving power. We cannot avoid it, we have no means at present of avoiding it, except by that very material of which I am an advocate, and, therefore, I may be fairly called upon to say a word about that which Captain Wilson "pooh-poohed" as being too dangerous. Now, I am not an advocate of petroleum, I have never been, I am an advocate of liquid fuel, under the form of creosote or heavy oil, and I can assure Captain Wilson that it has not the slightest explosive quality; I defy him to explode it in any way. It is far less dangerous than train oil, inasmuch as it will sink under water, which train oil will not. This does give the power for which Captain Wilson proposes to substitute sails. But I would venture to ask how he proposes that the sails should operate against wind as well as with it, and whether he would like to find himself opposed to an enemy moving with full power against a breeze, while he himself relies upon sails? I admit the great value of armour inside the ship instead of outside. If we can only put it inside the wood, if by any device we can make that wood incombustible, or render it less liable to strip off, the interposition of wood would necessitate the slowing of the shot before it strikes the armour, and the shot will have its hardest work to do after it has pierced the outside, which is more in accordance with the scientific disposition of the strength required from armour. I shall be happy to hear how the objections can be answered that I have adduced, with regard to the vulnerability of the outer hull of the ship.

The **Chairman**: Would any other Officer make a remark?

A **Visitor**: Did I understand you to say the vessel is 60 feet beam?

Captain **Wilson**: 65 feet beam.

The **Chairman**: Perhaps Captain Wilson you will now reply to Captain Selwyn's remarks.

Captain **Wilson**: Captain Selwyn considers that no pivot can be secure with the guns at present in use.

Captain **Selwyn**: Yes.

Captain **Wilson**: With the way in which ships are armoured now, he thinks the shot will penetrate, and that the pivot, although it is inside as it is in mine, runs the same risk of being knocked to pieces as one that is about half way in the ship's side. I think that is the statement he made. I should say that this pivot is in a position where it would never be damaged. There is a 9-inch armour outside it and the usual backing, and if the shot were to go through all that, its powers would be dispersed before it reached the pivot. That is my answer to that statement. With regard to the running in and out of the gun, Captain Selwyn seemed to suppose that this chain breeching will have an enormous strain upon it. But when it draws up the counterpoise weight, if the break on the windlass is applied by a careful hand, that will perfectly control it, and you can stop the gun almost at once if you like. That is my idea of the plan. The chain, I should say, would, of course, be quite equal to bear that strain, much more secure than by merely trusting to the friction of the gun on recoil. With respect to repairing the gun-carriage, I think Captain Selwyn expressed an opinion that an iron gun-carriage could not be repaired on board ship.

Captain **Selwyn**: I did not say an iron gun-carriage, I said any gun-carriage.

Captain **Wilson**: I beg your pardon, I understood you to say so. It is only a difference of opinion. I say a gun-carriage, if it is made in proportion to the strain of the gun, and is strengthened and breasted with iron, it is not a common wooden gun-carriage. I should say that that gun-carriage would be more to be relied upon than any other gun-carriage, and those gun-carriages we know can be repaired on board ship. And if a shot comes in and strikes a gun-carriage, the chances are that it will do very little harm as far as splinters go, and we know that splinters from iron are doubly more injurious than those of wood. With respect to training the guns, I perfectly agree with Captain Selwyn, that that is a matter of secondary consideration. I think by a judicious management of the helm, and with the assistance of twin screws, that very little training will be required for guns. If I was working these guns I should not attempt to train any of them, I should merely watch the helm and bring them on. Fighting end-on was the next point alluded to. I understand from Captain Selwyn that he does not consider fighting-end on of so much importance as I do, and that he would prefer the broadside to the end-on fire. Now I entirely differ from that view, because if you were bearing down on an enemy with a fleet of ten sail of the line armed in this way, you would have three 18-ton guns from each ship to bear as you approached the enemy, and if you were obliged to retreat you would have the same power available. Captain Selwyn agrees with me, I think, about the internal armour, but he is under the impression, I fancy, that the space between the outer skin and the armour is entirely open. It is not so, it is filled with cork, closely packed, all below the water-line. The upper part is entirely open, and, of course, if a shot came in there the water would always run out of the same shot hole. My object in filling the lower part up with cork, is with a view to the possibility of being rammed. Here is a model of Mr. Reed's ram-bow, the bow of the "Hercules," and here is my midship section. You cannot touch the bilge of my ship with the ram; the side may be stove in, I grant, but still the ship cannot sink. That is an immense advantage, for any other ship would sink. In the "Hercules" you see there is nothing to stop the ram from going right through the bilge, the most tender part of the ship. The next point was with regard to the spread of the rigging. The ship being 65 feet beam, her rigging would have quite sufficient spread, as much as the "Hercules" would have. There would be about the same, I should say. That is my answer to that point. I am not at all an advocate for the twin masts. That is the rig I would prefer (see Plate vi, fig. 1).

Captain Selwyn: For what size ship is that?

Captain Wilson: For this vessel.

Captain Selwyn: For 6,000 tons?

Captain Wilson: No, for 4,500 tons. She would have the largest sails here (pointing), the largest sail we have in the Navy. This would be about the size of the foremast of a first-class frigate. If the twin masts were used, you could protect them with very thick shields of iron. I do not apprehend there will be the slightest difficulty in firing through the opening between the masts—not the slightest. You might put iron as thick as you like upon it. Captain Selwyn also spoke of the rolling of the Symondite ships. I have been in several Symondite ships myself, and I beg to say that mine is not a Symondite ship. My midship section is nothing like that of a Symondite ship. The Symondite has not a hollow floor. In small vessels the Symondite is perfectly straight: in the larger ships the floor rounds out a little. The reason why the Symondite vessels rolled as they did, was their want of length. When Sir William Symonds built those ships, he was confined as to length; he could not build a ship beyond 205 feet long. My ship is 300 feet long, with a long hollow rising floor, carrying her beam a long way down past the water-line. I should say the rolling of that ship would be very easy; I do not see anything to prevent that ship being an easy ship. Short ships with full floor would certainly require more power; but I cannot agree with Captain Selwyn, or with anybody else he may be a naval architect, upon another point. I maintain that if you decrease the displacement a certain depth below the water-line, the ship will steam or sail faster, although she is a broader ship than one of the same length. It stands to reason, there is not half the resistance in the one case that there is in the other. How can there be? Does not the water come more freely to the screw with this rising floor. There can be no doubt about it. With regard to liquid fuel, I must say that I have no knowledge of the subject myself; I only speak from hearsay. I have understood that liquid fuel would be a dangerous thing to have on board ship. At present I do not see that we have anything to trust to but coals for raising steam. We know that coals will not last beyond a certain number of days; therefore, my idea was to give the ship all the power you could with canvas.

Captain Selwyn: Will you allow me to say, that I speak from actual experience with the fuel that I have mentioned. I have burned many tons of it.

Captain Wilson: With regard to the vulnerability of the outside, I do not dispute for a moment that that part would receive considerable damage. If, by carrying heavier armour inside, 9-inch armour, round your battery in every part of your ship, you can keep shot out, while another ship cannot keep it out, there must be an advantage on the part of my ship, which will more than counterbalance any damage that may be done to the outside skin. Mine is a better arrangement than to have the armour outside, and then to find that the shot goes right through the side, with nothing to keep the water out at all. When a shot goes right through the side and makes a tremendous hole, you cannot plug it up as you can in a wooden ship. I do not see that anything can be said against that part of my scheme. I think I have now answered all the objections that have been raised.

Captain Selwyn: I understand you expect the cork to keep out the shot?

Captain Wilson: Of course the cork will have the effect, if it is closely packed, of deadening the force of the shot before it strikes the armour. The armour is inside the cork. The space between the armour and the outside will be filled entirely with cork right along from top to bottom. Cork is a very durable thing. If you look at a common fisherman's net, you will see that the cork will remain for years and years, as good as ever. The commonest cork will do; you may jam it in as tight as you like. In case of being rammed, which promises to be one of the modes of warfare in the future, if you can save your ship from sinking by the use of cork, you will have gained a great advantage.

The CHAIRMAN: We have to thank Captain Wilson for this opportunity of seeing a new plan. We may have our own opinions about it. For myself, I think there are many details there with which I should not agree. But it is one of those schemes with respect to which we must say the proof of the pudding is in the eating. With my present knowledge, I rather doubt about the gun, and about the recoil, and about one or other points that Captain Selwyn has mentioned. But with regard to the main point of putting the armour inside, I think that is a great advantage, provided we could always prevent the outer skin from being the means of the vessel getting water-logged and sunk in that way. Did you say that the ship is armoured outside?

Captain WILSON: No. She would not be water-logged, because she is filled with cork up to the water line; so that if the water came in above the water-line, it would run out again. I have calculated that supposing the compartments were filled, it would bring her down 8 inches, and no more.

The CHAIRMAN: There is one point in which we might so far agree with Captain Wilson, that it would be desirable if the authorities were to investigate these things a little more. They cannot always do that. But I am afraid that we shall not, in our day, see a board appointed that will examine all inventions that may be brought before them. The current goes in the other direction, in the way of reduction with the authorities. Therefore, I do not think we shall see that hope of Captain Wilson's realized. However, there is one point in which we may all agree, and that is in thanking Captain Wilson for having given us the opportunity of seeing this plan; and, if we do not agree with him in all its details, we have, at any rate, learned a lesson from it, which may some day be turned to account. We are very much obliged to him for reading us his paper.

Evening Meeting.

Monday, February 15th, 1869.

Admiral Sir HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 15th February, 1869.

LIFE.

Nicolson, C. A., Lieut. R.N. 9*l.*

Crealock, J. North, Capt. 95th Regt. 9*l.*

ANNUAL.

Daunt, John C. C. V.C., Capt. Bengal Staff Corps. 1*l.*

Roe, Herbert F., Paymaster R.N. 1*l.*

Hay, J. C., Capt. 92nd Highlanders. 1*l.*

Bridgeman, Hon. Francis C., Lieut. Scots Fus. Gds. 1*l.*

Scarlet, Leopold J. Y. Campbell, Lieut. Scots Fus. Gds. 1*l.*

Babington, C. W., Lieut. 9th Bengal Cavalry. 1*l.*

Huleat, Hugh, M.A., Chap. R.N. 1*l.*

Leigh, H. M. C., Capt. Gren. Gds. 1*l.*

Ranfurley, Earl of, Lieut. Gren. Gds. 1*l.*

Roberts, H. B., Major Roy. Marine Art. 1*l.*

Hamilton, Charles Edward, Lieut.-Col. 80th Lan. Rifle Vols. 1*l.*

Campbell, F. Lorn, Lieut. Scots Fus. Gds. 1*l.*

Kennedy, A. F., Com. R.N. 1*l.*

ON DEFLECTING-ARMOUR-PLATED SHIPS FOR COAST DEFENCE.

By Mr. J. M. Hyde.

There is no subject of so much importance, and so necessary to the existence of England as a first-class nation, as that of its Navy. The insular position of England gives her a security that can only be assailed by a naval force, and hence the importance of her possessing an efficient and well-appointed Navy.

"Naval affairs" often form a subject of discussion. Indeed all parties admit that England should be in possession of the best and most powerful fleets; her marine, her wealth, her intelligence, and the position she has held, demands it, and however much it might be the fashion for some to underrate this necessity, sad indeed would be the day when this particular arm of the United Service should be neglected.

In the earl [illegible] fights of England, sailing ships alone were used,

of our soldiers; such cases are familiar to those who have knowledg of actual war. There is, perhaps, no modern case of such grav importance, and affording such singular proof of the advantage o deflection as the case of the recent attempt on the life of His Roya Highness the Prince Alfred; had not the ball of the assassin bee most providentially fired obliquely, and hence deflected, the life of Hi Royal Highness must have been sacrificed. We must all, therefore rejoice that by the deflection of the shot, we were certainly saved great national calamity.

The armour-plates first applied to ships did not, I believe, excee 3 or 4 inches in thickness; these have been gradually increased as th guns have improved. There is, however, no occasion to recapitulate t numerous experiments that have been made both in shields and gu up to the present time; those interested in the question must ha read the results given from time to time in the public pape Numberless have been these experiments, and the results of the cont between the guns and the armour show the deep importance the question. Between the 4-inch armour of a few years since, I may say the 14-inch armour of the present day, there is certai a great stride. To arrive at this thickness, endless experiments h been carried on for many years past at a vast expenditure, and t grand result may be said to be centred in this one fact, that a *chill* shell from a 600-pounder gun will penetrate a 10-inch plate and pa through it. This is certainly a fact beyond dispute, as is shown the firing at Shoeburyness; and even a 15-inch plate has be broken up by such projectiles. Of the practicability of building shi to carry even thicker armour than of 15 inches, I am bound to adm but as to their cost, stability, and seaworthiness, without investig tion I dare offer no opinion. The gradual development of any syste that presents a chance of success, if economical in construction, seen more desirable. With this object in view I have, since the ye 1853, made numerous experiments and designs for armour-plated shi on the principle of *deflection*, feeling quite sure that any vertical stru ture that can be carried by a ship of reasonable tonnage will be pen trated by modern artillery; however ingenious that structure might b

All the artillerists of the present day are agreed upon this poi and however unpalatable the truth, it cannot be disputed; those w saw the practice against the 15-inch plates recently at Shoeburyne must have seen that vertical armour-plates, even of that thickne would stand but small chance against the skill of the Woolwich gent men; the shot buried itself 11 inches in the material of the plate, a shell so striking, exploded and blew off a large segment weigh some tons. There were two of these plates fired at, one of them h mered, the other rolled, and both produced with great care by the m celebrated makers of the day; yet both were destroyed, broken into large fragments. Had these huge plates been hung on the s of a ship and assailed by similar guns, the result would have been t same—certain and positive destruction to the ship receiving the la shot. If 15-inch armour can be so broken up, what then is the use o hanging 6- or 7-inch plates on a ship's side? The question is natural

HYDE'S

*Double deflecting Armour Plated
shot proof ship designed to have
easy draught of water and steady
Gun Platform*

Fig. 1

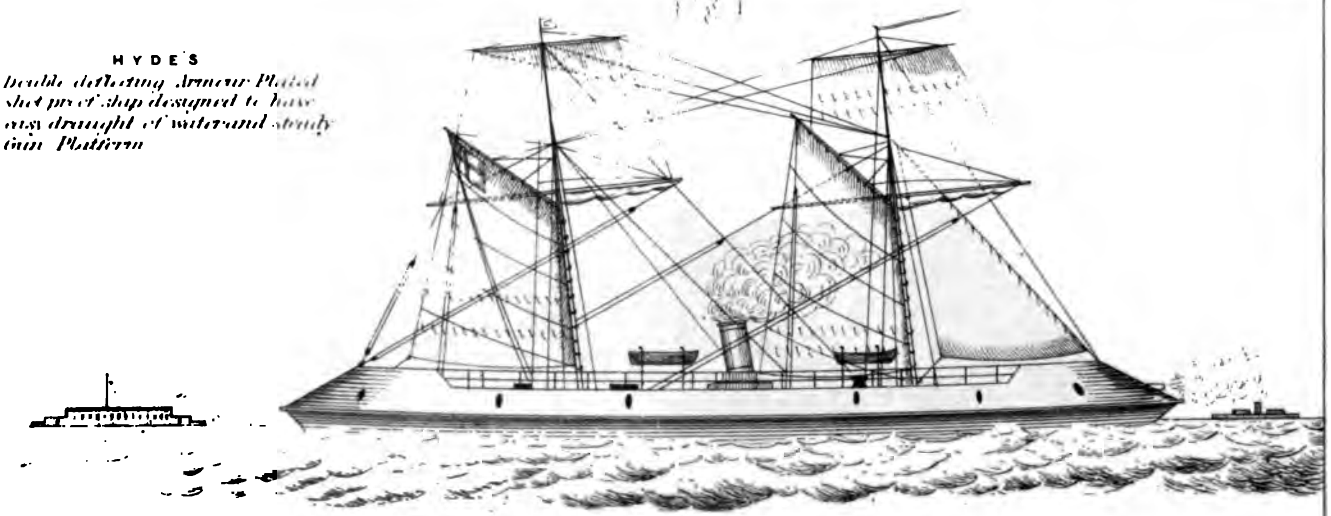
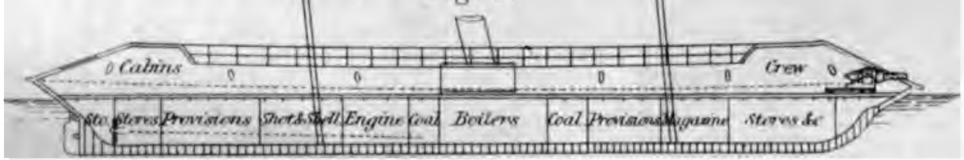
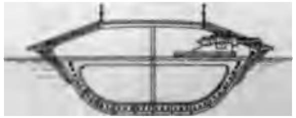


Fig. 2.



Longitudinal Section.

Fig. 3.



Midship Section.

We sometimes hear it said that all naval powers are alike in this respect, and this is offered as some consolation. In these modern days of keen competition, circumstances rapidly change; what is new to-day is old to-morrow, and the race must still go on until the time shall arrive when all men will be of one mind, and will not only agree to use no explosive bullets, but to use no bullets at all. Until that day does come, however, we must still be prepared and so prepared, as to be able to meet every possible contingency. What then can be devised to "keep out these direful shells?" Obviously, deflecting sides. Vertical structures must either be made so thick, and of such rigid material, as to stop by main force a projectile moving at the rate of 1,300 feet in one second of time, or they will be penetrable, and thus useless; whereas deflecting sides, if at an angle sufficiently acute, will cause a projectile to ricochet from its surface, and expend its force in the atmosphere, or in the sea, instead of in penetration. This fact is certainly well known, and has often been alluded to in the description of some modern ships. For instance, I have noticed that lighter armour-plates have been used in places where shot can only hit at an angle, as under the counter. Again, some ships are especially designed for *end-on* duty, that a small section only may be presented to the enemy, and this a curved or angular surface. Deflecting-sided-ships may be said to be *end-on all round*; and, in a general action, would offer no point for special attack, and therefore possess an immense advantage over the ordinary *end-on* ship, which is open to be penetrated at the stern and on the broadside in a general action.

I have heard some gentlemen argue the great importance of the ram as a means of offence, and doubtless a ship of 3,000 or 4,000 tons, steaming at the rate of 12 or 13 knots is capable of doing great damage in the event of a fair hit. My deflecting-sided-ship, I have no hesitation in saying, is proof against this very modern naval operation of ramming. The horizontal rib, extending all round the hull, quite prevents any injury from ramming. This projecting rib of solid metal 18" deep, is a safeguard no other ship possesses, an arrangement in the design of a deflecting-sided-ship of the greatest value. Armour-clads, ramming at each other, are not unlike animals butting at one another when engaged in deadly strife. This is certainly not a very dignified operation, the one being a fight of physical, the other of mechanical force, a mere pugilistic encounter, in which science forms a very secondary part; but so long as ships are made to ram, certainly others should be constructed to resist that operation.

Model No. 1, represents an armour-plated double-deflecting ship, designed for coast defence. The extreme length of this vessel is 255 feet, extreme breadth 60 feet, breadth at water-line 50 feet, depth of hold 13 feet, height between decks 7 feet 9 inches.

I need not say these particulars may be varied to suit circumstances, thus the beam and depth may be increased to admit of larger stowage of coals, and would be a simple matter of calculation.

The profile drawing (Plate vii., fig. 2), will show the internal arrangements of such a ship, among which I particularly wish to notice the large deck accommodation for the crew, entirely above the water-line, so that there would be no occasion to pump in the vital air to the crew, as they do in coal mines.

The drawing fig. 3 is a midship section of this ship. One of the peculiarities of my system is the external application of timber to protect the armour. This I have found by experiment to be the true and proper place for a timber lining, and it forms an important feature in my plan. The external timber cushions a projectile, and in this case alters its line of flight before it reaches the metal plates. The shot in passing through this timber carries a portion of the compressed fibre of the wood before it, and thus distributes the force of the shot over a larger base than the apex of the projectile, upon which the whole force of the work to be done is concentrated. Although this is self-evident, yet mere assertion in this practical age can make but small progress unless supported by actual experiment. I have therefore made a series of experiments to illustrate the principle of *deflection*, the results of which are here, and, with your permission, I will hereafter explain them. Hitherto artillery and target experiments have been carried on at very great cost, in consequence of using the actual full-sized guns, targets, and ammunition. Now, as that would be entirely out of the question in the case of a private individual, and as the difficulty of using for experiments, material belonging to the State is equally out of the question, it occurred to me that a fair result might be obtained by reducing all the elements in an experiment to a scale. These so reduced, would then be within the power of any one. Instead, therefore, of firing at full-sized targets, with a full-sized gun, I reduced the entire system to a scale of 1 inch to the foot; and, although it may appear remarkable, I have obtained similar results to those arrived at with the large guns and targets, as I hope shortly to explain.

But to return to my ship. The midship section, fig. 3, shows the usual construction of war ships as regards the bottom; this is cellular, having an outer and inner skin, with various water-tight compartments, the sides however are sponsoned out as shown, to a point some 3 or 4 feet above the load line; from this point the top sides fall in-board, at an angle of about 20°, the two angles combined not exceeding 45°. The mode of securing the armour plates to the inner skin is by bolts in the usual way, but the armour plates are riveted together at the apex of the angle where they are flanged for that purpose; these flanges are 18 inches deep, and when thus fitted together, form a mass of metal, so arranged as to be not only difficult to hit, but when hit, the metal to be disturbed is so large in quantity as to be equal to withstand even a 600-pounder. Upon the outer surface of this armour, I place a timber facing, as is shown in the drawing; this timber, if 1 foot in thickness, will offer for penetration in the horizontal line a thickness of 30 inches, assuming the projectile would pursue a straight course. That, however, is really not so, as the timber when placed at the angle adopted, causes the shot to ricochet somewhat before it comes to the metal; it thus receives a curved motion, and is therefore the easier deflected when contact is made with the metal.

These angles are continuous all round the ship, and if the beam and length were the same, such a craft would be of course circular—hardly a ship-shape form of construction—but equally shot proof, if made oval as in the shape suggested by this design, or circular, as suggested by Mr. Elder, in a paper recently read by him at this Institution.* As a practical proof of the advantage of an external facing, I selected two ¾-plates, one a naked plate, and the other faced with 1-inch timber representing 12-inch in the full size. The naked plate was the first fired at, and the result, as you see, was perfect penetration. In this experiment the same shot, charge, and range, were used as in all other experiments. In the second experiment on the plate faced with 1-inch timber, with the same weight of shot, charge, and same range, the result was very different indeed; the timber of course was penetrated, but not the plate. Now this is easily accounted for with round-ended shot, the fibre of the timber is compressed under the blow, is in fact condensed, and must be almost of equal density with the metal itself, the powder force is therefore distributed over a base equal to the area of the shot, and hence the resistance of the plate so protected. With a pointed shot, however, the result is different, deeper injury, but not actual penetration. These experiments clearly show the importance of placing a timber facing on the *outside* of armour plates as well as on the *inside*.

The gun I used in these experiments represented a 600-pounder on a scale of 1 inch to the foot. The 600-pounder gun is known as a 12-inch gun weighing some 23 tons; the bore is 12 inches in diameter. Reducing this to a scale of 1 inch to the foot would make the bore exactly 1 inch in diameter. The shot of the full-size gun is 18 inches long, this reduced to 1-inch scale, would, of course, be 1½ inches, and the full charge of powder represented by a cartridge of about the same length. Now the experiments at Shoeburyness have shown that a shot from the 600-pounder gun has penetrated a 10-inch plate. I have seen the holes in a 10-inch plate, and there is no doubt of it, and in making my experiments, I have taken the proportion of 1 inch to the foot all through. In my targets, a 6-inch target is represented by ½-inch plate; a 9-inch target by ¾ plate; a 12-inch by 1 inch; the range too reduced from 70 yards was some 17 feet—thus the gun, the shot, the powder, the target, and the range were all reduced to the same scale, and the result was the same, viz., that my target representing the 10-inch plate was penetrated as the 10-inch plate was with the big guns. The experiment is of equal value, but was of infinitely less cost, and I may be pardoned for holding the opinion, but I believe that very great and important results may be obtained by carefully making such experiments upon a reduced scale, and thus save a vast sum to the State. In the one case the result of penetrating a 10-inch plate was obtained by the expenditure of many thousands of pounds, in the other of a few shillings only.

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* Vide Journal, vol. xii, page 529.—Ed.

Having thus found that a 10-inch plate can be easily penetrated, we may fairly argue that even thicker plates would be in the same condition with bigger guns; indeed the gentlemen at the head of the Artillery Department, all say that they can penetrate any plate that can be produced. Where then is to be the limit, what the cost of ships equal to such elements? what the risk and cost of navigating them, if compelled by modern artillery to carry such armour? Is there no other system of construction? Yes, by deflecting the hostile shot, since it cannot be kept out. Let your ships be made in the form of these models, and the result will be invulnerability; ships shot-proof all round from stem to stern; no weak points at the ends, as well known to any possible enemy as to ourselves; ships proof against that very modern evolution of ramming; ships with an uninterrupted deck *above* the water line, thus rendering it unnecessary to support the crew with *air* by artificial blowing machines; ships easy in a sea-way from the buoyancy given them by the sponsoned sides. Now, in proof of the advantage of the deflecting-side, I have constructed a target to illustrate the effect on a ship. This target is made of homogeneous metal, tempered by a peculiar process, it is riveted together just as the sides of an actual ship would be, and has been faced on the outside with timber to act as a cushion to the shot before it reaches the armour plate.

This target, representing the side of a ship, has been fired at with the same shot and charge as were used in the other experiments, and fairly represents the effect of a 600-pounder on such a ship, and the result, as you see, is partial destruction of the timber, but no injury to the metal beneath. This experiment gives a result I am certainly justified in claiming for a similar experiment if made against the actual ship's side, and clearly proves the vast and immeasurable advantage of this system of construction over any other yet suggested.

It has been urged by some gentlemen who have seen these models that deflecting-sided ships fitted with turrets, would be the most perfect and apparently the most efficient ships that could be produced. To make a model turret and fire at it with even a model gun would occupy considerable time and add much to the cost of my experiments; but it would most certainly be alike satisfactory to the advocates of the turret-system to have it tested by the largest of our guns, and also the tax-paying public to be assured, that the sums to be expended in the construction of turret-ships would be so expended with some chance of success in actual war. Of the wisdom of leaving so grave a question in doubt, I offer no opinion; I may, however, express a hope that abler men will be led to urge its deep importance upon the attention of those who have the power to order a full and careful investigation into the entire system. I may add the singular fact that I have never yet been able to find a thoroughly practical mechanic, when called upon to give his real non-official opinion, that is, the true and candid expression of his judgment and experience, upon the turret and its machinery, but who has invariably expressed a *doubt* as to its capability of withstanding the rough usage of war when assailed by big guns. I pray that so direful a calamity may never happen to this country as the failure of the system so generally adopted, when too late to alter it.

I have extracted from a work recently published by "Von Scheliha" on "Coast Defence," a list of the armour-plated turret-ships of the United States engaged in the attack upon Charleston in 1863, and the effect the Confederate guns had upon their turrets. From the official report it appears that there were 9 of these ships engaged in the action; of these, 1 was sunk, 3 withdrew out of action, and the remaining 5 had their turrets all injured and jammed.

United States Armour-plated Turret-ships engaged in the Attack on Charleston, 1863.

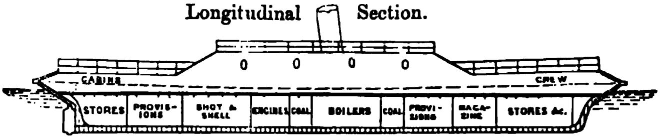
"Weeshawken," *turret injured*, went out of action.
"Passaic," *turret jammed.*
"Montauc," withdrew out of action.
"Patapsco," *turret jammed.*
"New Iron Sides," Admiral's ship.
"Catskill," withdrew out of action.
"Nantucket," *turret jammed.*
"Nahant," *turret jammed.*
"Keokuk," sunk.

These reports all appear under official authority, and are detailed reports of the individual Officer in command of each ship, and are embodied in the report of the Commander-in-Chief to the Secretary of State, and are most authentic records of a very important action, and certainly ought not to be lost sight of. If all future war-ships were only armed with 68-pounders there would perhaps be little difficulty with the turret system, but when 300, 600, and even 1,000-pounders will be the most probable guns of the future, then it would certainly be only fair to test a turret with a few 600-pounder shots before committing the Navy of England to such an untried system.

Ships of my construction would answer the purpose of forts moored in particular harbours, and at the same time would admit of their going to sea.

The application of Messrs. Dudgeon's system of twin screws with independent engines, which is now so universally copied by builders of war-ships, gives such craft an opportunity of manœuvring to the best advantage. It might be objected that so much armour, and such heavy guns at the ends of a ship, will be a disadvantage, if such craft had to fight at sea.

To obviate this the ends may be cut down, as in the model, No. 2, and the guns placed in a deflecting casemate amidships; in this instance the position of the guns will depend upon the size of the ship and their weight. Such a form seems very likely to represent the future line-of-battle ship: deflecting-casemate, and sloping-sides certainly offer the best chance of keeping out modern projectiles.



DEFLECTING ARMOUR-PLATED SHIP WITH CENTRAL CASEMATE.
(Scale $\frac{1}{64}$ of an inch to a foot.)

There is another point to which I wish to direct the attention of the members, and that is the oft-repeated idea of conversion. This has been the subject of much debate, and is certainly well worth attention, on the score of economy. There are many very splendid hulls yet remaining from the fleets of former days; the best of them may be made to do efficient duty as deflecting-sided ships.

I have shown a design for conversion in the drawing before you. This is the mid-ship section of a line-of-battle ship, and upon it I have placed a section of a deflecting-side. What I would propose, is to cut down all the upper decks and sides as low as the lower deck, and upon the remaining bottom, build an independent system of angular sides, so arranged and so fitted that when the bottom had become by age unfit to give safe support to the iron structure above, a new iron bottom of the usual form may be added. Thus you will utilize the present ships without destroying the added structure for reconversion again. This, I think, is a very simple and cheap conversion, and may certainly be tried at comparatively little cost. In submitting this idea for the conversion of some of the finest of our wooden ships, there are two important essentials; the first is the preservation of the present fixed machinery, which need not be moved out of the ship, and the second, that the added structure would be available for a new hull, when the timber had become too old to be longer trusted. The details of such a system of conversion are not shown in this drawing, details being a matter of professional arrangement. Such a system is, of course, like all other systems, open to criticism, and hence I have ventured to introduce it, that in the discussion, which usually follows a paper read at this Institution, some notice may possibly be taken of it.

To those who contemplate building armour-plated ships, it would appear desirable to consider the question, whether vertical sides, even when plated with the thickest armour, will keep out the most modern projectiles. The experiments at Shoeburyness answer that question indisputably. Will naval powers, on the other hand, agree to use small guns? this would be a desirable arrangement, but we must consider it impracticable.

I may then, as an advocate of the deflecting-sided system, most earnestly urge, even on the score of humanity, that it should be tested in an efficient manner. It can hardly be expected that an ordinary individual should, at his own cost, enter upon the construction of a full-size target. It must be acknowledged that in the production of such models and experiments as are here shown, a considerable sum has been already expended; and although they show what the result would be in the actual ship, yet a target made on the principle of this model of a deflecting-sided ship, would at once demonstrate its advantages. There is certainly no naval power in the same financial position as England. To such, a shot-proof ship of moderate cost would be an essential of the greatest moment; and to such I would say before expending large sums in ships of doubtful vulnerability, consider fairly whether double deflection is not the true form of construction for economy, seaworthiness, invulnerability, difficulty of capture by boarding, and last, though not least, comfort for the crew.

It is very well known that naval powers generally are not only seeking every kind of information upon the subject of ships and guns, but are actually preparing themselves with both as rapidly as circumstances will admit. Take, for instance, the fact of the Americans possessing a host of 15- and 20-inch smooth-bores. The fact also of the Prussians being engaged in the manufacture of the largest guns our Shoeburyness experiments have taught them the necessity of. These and similar circumstances show how important it is that any possible contrivance, having a chance of success, should be investigated, that England may not be compelled to concentrate her energy at an enormous sacrifice when a naval panic places her at a disadvantage. The public, if we may judge from the interest taken in this question by the paper, quite understand its importance.

I remember to have read in the *Times* of December 8, 1866, the following remark:—"We learn from experiments now reported, that a large percentage of shots would be rendered practically harmless by such an inclination of a ship's side towards the muzzle of a hostile gun." Now this is what I have endeavoured to urge for the past 16 years, and I hope, in the course of a few more, to see such a system adopted. Every day's experience confirms its importance, and those who are conversant with these subjects, cannot fail to acknowledge its practicability and usefulness, for, however much we may rely on the pluck and daring of the British Officer—qualities we know they possess in the highest possible degree—there is another element we must not forget, that of the British seaman, once a numerous race, that seem, from some unexplained cause, to be passing away, and hence the necessity of giving those we have, a fair chance when called upon to fight the enemy. This too, is an argument in favour of a ship that can successfully keep out the hostile shot. Skilled seamen and gunners take some years to produce, and when educated for such duties at great cost and care, are certainly more likely to be of service to the State in a shot-proof ship than in a ship vulnerable at all points.

The great and rapid changes which have taken place, and which will, doubtless, continue to take place in the design and construction of ships suitable for the purposes of war, offer to a wise statesman a subject of deep investigation. Naval tactics, like military evolutions, when skilfully performed, are said to give important advantages; but these can hardly be accomplished without such material in the shape of ships and guns as shall ensure success. England has the means to obtain, and the desire to possess—her statesmen all acknowledge that no circumstances should prevent the possession of—the most powerful fleets. Her people have at all times been most ready to bear any cost for such efficiency, and although the ships now built are grand and magnificent structures, reflecting the highest possible credit upon those gentlemen under whose care and judgment they have been designed, and whose experience had given such great perfection, yet their vertical sides have an acknowledged vulnerability. Let us hope then that some plan will be suggested to keep out those fearful shells, and, in the absence of any better, I have been permitted by the Council of this most useful and valuable Institution to introduce to your notice these models and drawings. They explain a system I have worked at for the past 16 years, and I claim to add that the result of experiment in every variety of form, shows that a glacis all round a ship externally covered with timber, will cause projectiles to ricochet, and that such is the system that offers the best chance of success against the guns of the present day.

Description of Targets.

Targets 1 and 2 are representatives of 6-inch targets; that is, they are plates ½ inch in thickness, No. 1 being of iron and No. 2 of homogeneous metal tempered. They were fired at with the same shot and charge, No. 1 being penetrated and No. 2 only bulged, thus proving the great advantage of homogeneous metal.

Targets No. 3 and 4 are representatives of 10-inch targets. No. 3 being a naked plate and No. 4 protected with timber equalling 12 inches. The first shot at No. 3 was of cast-iron, similar to that marked 1 on the board, and the remains of the shot fired are placed with it. No. 2 shot of this series was of wrought-iron, the shot fired is also placed on the board: the impression on the target with both the cast- and wrought-iron shot is small. No. 3 shot was of tempered steel, this penetrated the target; the shot is also on the board. No. 4 and 5 were fired at an angle of 10° and did not penetrate. No. 4 target, lined with wood, was not penetrated, and the shot is still in the metal, thus proving that the wood is an advantage even in a vertical position.

No. 6 target represents the angular sides of a ship; one side of this target is faced with wood, the other is naked. Upon examination, it will be seen that the wood has entirely prevented the shot from even touching the metal. The naked half of this section was also fired at, and the result was a small indentation only; there can be no doubt, therefore, that a similar result would be found in firing at an actual ship with a full-size gun.

No. 5 target is a representative 12-inch target. The first shot only got half way through, but, with an extra half charge of powder, the second shot, as you see, very nearly penetrated. Both these shots were uninjured.

Mr. Hyde: If you will permit me I will now further explain this target (No. 6) representing the side of my ship, as the experiment was a most remarkable one. In firing at this target, the wood actually made the shot ricochet. This is the piece of wood placed upon the target in an early experiment. If you examine it, you will find that the shot has simply grooved out the wood, and the fibre is torn up, but it failed to penetrate the wood, it did not touch the iron. That result was so astounding and marvellous, as showing that mere vulgar wood would keep a shot out of a ship, that I repeated the experiment on two or three occasions, and found the same results. You will notice that there were two shots fired here, and they failed, both of them, to penetrate the wood,—they ricocheted from the surface and passed away.

It might be asked: what would be the effect of a plunging shot? This (pointing to a target) is the effect of a plunging shot. A shot was fired so as to show the effect, but it failed to get through the iron. It went through the wood, but not through the iron.

This diagram shows the thickness of the wood, a foot in thickness, as would be used in my construction. A shot penetrating, assuming it went in a straight line, would have to go through 2 feet 6½ inches. Probably it would ricochet, as in this case, pass off and go away without reaching the plate at all. This diagram represents the full-sized plate of 3 inches, The midship section shows more clearly how the armour-plates would be secured, and the wooden facing on the outside.

The Chairman: If any gentlemen would like to make any remarks or ask any questions, Mr. Hyde will no doubt answer them satisfactorily.

The points on which I should like to be enlightened are, firstly, what power of training right and left will there be in this gun with that surface to point through? I do not quite see that there is the same power of training right and left here as you would have in a vertical side.

Again it seems to me that such a ship as the one represented would be more suited for coast defence, than for sea-going purposes, inasmuch, as I think in the first place she would roll more, and her upper deck would probably be swept continually. These are two of the points I should like to hear more about. Do I understand also that no shot ever penetrated the iron through the wood? As for instance there: (pointing) what became of those shot? Did they lodge in the wood, or go on away, or did they remain? I see one has remained.

Mr. Hyde: This shot must have fallen out; it could not be found.

The Chairman: I conceive that the ricochet of the shot would be very mainly determined in this case by the fibre of the wood being in that particular line, but supposing the fibre to be the other way, I do not suppose there would be any necessity for placing the wooden *facing* with the fibre that way; but supposing it were, I presume the shot would have a better chance of penetration than it would with the fibre placed in the way in which we see it.

Captain Beamish, R.N.: Mr. Hyde has pointed out a piece of wood through which a shot did not go, was that shot fired vertically at that piece of wood, and had it armour plating behind?

Mr. Hyde: The piece of wood was placed in the position you see it on the model.

Captain Beamish: May I ask what is its thickness in proportion to the iron?

Mr. Hyde: Three inches of iron and twelve inches of wood.

Captain Beamish: Another thing that struck me about the construction of vessels on the principle before us is this, that at sea they would be very likely to be severely struck in the rise and fall of heavy seas, in consequence of the shape of the vessel being so very much over-hanging. As far as my experience goes, vessels with large sponsons offer very great resistance to the sea, and it appears to me that this vessel, though it certainly would offer immense advantages in the way of deflecting shot, offers the disadvantages all round that a vessel with an over-hanging stern offers only at the stern, or which one with an over-hanging bow offers only at the bow. I do not know whether Mr. Hyde has had any opportunities of testing it, he cannot have done it with mere models, but it strikes me that with that construction there would be a very great strain upon the vessel from over-hanging weights, such a strain as comes to a vessel which has an over-hanging stern or bow, more particularly when the guns are run out.

The Chairman: I was going to mention that at sea, be the ship what she may, with the wind on one side, she would always heel over a great deal, to say nothing of the rolling, and in that case I presume she would suffer much more from the enemy's artillery, because the shot would be very liable to go below that deflecting surface, and the deflecting surface under those circumstances would not be at the same invulnerable angle that it is when she is on an even keel. That is supposing she was a sea-going ship; for coast defence it would not be so.

Mr. J. B. Wilson: I would ask whether exactly the similar results would be attained with full-sized artillery and full-sized targets as were obtained with the model, or whether it is not a matter of calculation and also of experiment, whether full-sized guns would not prove more destructive to full-sized targets than was found in the case of the model targets.

Mr. Samuel J. Mackie, Associate I. C. E.: With reference to what the last speaker said with regard to the full-sized targets, having had great experience in these things at Shoeburyness, I must confess my very great surprise at finding that these targets, particularly No. 3, as any one may see, so accurately show in miniature the various forms of perforation made upon the plates of larger size. If any one will look at the back of that plate they will see the same four rays breaking out, and similar bulgings at the back; they will see a large circular disc broken away, and on examining the front of the plate, will perceive the same ripple mark round the hole in a manner marvellously like those which are witnessed in the experiments at Shoeburyness.

With regard to that plate, and the wood that is put in front of it, it has caused me some astonishment. If I understand it rightly, it represents a 3-inch or 4-inch plate covered with 12 inches of timber. We know perfectly well if a plate of 3 or 4 inches thickness, backed with 12 inches of timber, is hit direct from a 600-pounder, the shot will pass through it as through pasteboard. If you get such results in practise from a 600-pounder it will show that the deflection of the plate has an exceedingly high defensive value. Of course, when allusion is made to experiments on a small scale, I cannot for one moment admit that it would prove any economy to the nation to try experiments on a small scale. Experiments on a small scale are suitable for inventors, and have been carried out by many of them, as by Major Palliser and others, before their inventions were brought forward to the public or to the Government, but experiments on a large scale must be necessary before practical works could be engaged upon. No acceptation of any principle could ever be made upon a small model, it must and ought properly to be tried on a large scale. With regard to the over-hanging shape of the stern of the vessel, and of the sides and bow, it is a point upon which I think it would be well to have some further consideration than the mere over-hanging of the sponsons of a vessel would give us. There seems to me to be in the over-hanging of a vessel of this kind an enormous dead weight, which is very different to the over-hanging sponson of an ordinary ship. This dead weight I apprehend is a certain amount of weight to be elevated against gravitation, and which action must to a certain degree absorb much of the momentum of the striking object, or wave. I think that is a point worthy of investigation with regard to a structure of this kind. There evidently is a great deal of defensive resistance to be got by angulating the target, we have seen this at Shoeburyness in the 8-inch Warrior target, part of which is at an angle of 37½ degrees, representing the bow of a ship, for in no case did the Palliser shot penetrate that. In fact, the ogival head of a Palliser shot especially, is pretty nearly certain to be deflected in consequence of the form of the head. This happens even from as yielding a surface as water. I had no idea of speaking this evening, but these are some of the points which appear to me to be worthy of consideration with respect to the plan submitted.

Mr. Hyde: Referring to an observation you, Mr. Chairman, were kind enough to make, with regard to the training of the gun, of course I need not tell you that to give a gun a large amount of training, you must have a very large port, or adopt the muzzle pivoting system: the large port is a point in the structure of ships that one generally tries to avoid. I might say the modern application of the double screw or the hydraulic system of steering almost prevent the necessity of giving a ship a very large port, for she can be twisted and turned with the double screw almost as readily as the turret itself. However, the trainage here would be, perhaps, a point, fore and aft, unless the port was made large.

As regards your remark about the fibre of the wood, in making such a structure, no one would, for a moment, place the timber what we call practically, fore and aft—it would all be vertical. If a shot struck the side of a ship, where the timber had been fixed fore and aft, it would possibly destroy a dozen planks, whereas, if the plank was placed vertically one only, or one and a half, or two might be destroyed. So that in all cases the fibre of the wood would be direct to the flight of the shot as it is placed on this particular surface.

As to the rolling of the ship at sea that is a question which it is almost impossible for anyone to answer satisfactorily. We can only say that merchant ships, having sponson sides, are known to be easy ships in a sea-way; and as an illustration of that, I would allude to a ship navigating our own River Thames. I think it is the "Lion." This is a ship with a sponson side. I have gone on board that ship, and asked the sailors how she behaved in a sea-way, and they all say the ship was the most buoyant craft that they ever sailed in. We do know, as a fact, that small boats, the sides of which are mainly sponsoned, so to speak (the greatest breadth of a small boat being just at the gunwale), we know that little boats live in a sea that a big ship would founder in. That is a well-known fact, so that as far as my judgment and my inquiry go, ships with sponson sides would be more buoyant and more seaworthy than those with vertical sides only. Of course, these vessels are supposed to present the smallest possible surface to the enemy, and hence would swim, perhaps, three or four feet out of water. The point is to keep a shot out of a ship. If you are obliged to put 14-inch armour or 12-inch armour upon a ship, she must be very large, the displacement must be very extensive, and even then we know that vertical structures are still vulnerable. Hence this is resorted to. I do not mean to say that there are not disadvantages. A heavy sea rolling over—that cannot possibly be avoided. You cannot have the old wooden structure and the armour-plated shot-proof ship too. If you want a ship made shot-proof, you must either give her a form of this kind, or else you must have her sides so thick that the structure must be monstrously big—some 8,000 or 10,000 tons—to carry it.

As regards the heeling of a ship of this description, and the exposing a weak part of her structure, all ships are the same. If you take a broadside ship of the present form, she is just the same; if she heels over, she exposes her weak points below. If you give a ship of this class sufficient beam she would not expose her weak points so frequently as a vertical-sided ship, and these ships must have more beam to carry their weights, so that the weakness below the water is much less than it would be in an ordinary ship.

As regards getting the same result from the model that you would from a big gun—well, that is a question of deep research, which I confess I am not able to answer off-hand. All I can say is this, that with a gun an inch to the foot, and a target an inch to the foot, you get the same results they have got at Shoeburyness. If you reduce your 600-pounder to half the size, you get half the duty; if you reduce it to a quarter the size, you get a quarter the duty, and you may go on down to one-twelfth the size. I think the argument is a good one, and I think it is highly probable because the results are the same. If the results were not the same, then I might say the experiment was defective, but with a similar result as to the penetration of a plate equal to a 10-inch plate—the only plate they have fairly penetrated is a 10-inch plate—the 12-inch plate or the 15-inch plate they did not quite penetrate, it was broken up in fragments,—but the 10-inch plate they have penetrated: so we have here, the shot goes through it, and I have no doubt experiments, however numerous, made under similar circumstances, will yield the same results. I have brought the targets, I have brought the gun, I have brought the shot, and the result is here. Anybody may make the same experiment.

The only reason the overhanging form is given in this particular mode of construction is simply to get rid of the shot: we know we cannot get rid of it in any other way. However thick, or however big you may make your plates, gentlemen, at Woolwich, say "We will knock them all to pieces if we cannot get a shot through." Therefore, we must make something that will keep the shot out—of course, there might be something better,—but in the absence of any better, I present you with this. If you have any better scheme for keeping shot out of a ship, then I make my bow: at present I say this is the best.

It has been noticed that the weight at the ends may be disagreeable. I am not prepared to say it would be disagreeable, especially for coast defence, because in a ship entirely devoted to harbour duty, or coast defence, there is no probability of her getting into Atlantic waves. But in the event of a ship going to sea in a gale of wind, take the ends off and we present you with a form of this description—we put a casemate in the middle with a glacis all round it. Remove the weight from the ends and keep it in the centre; but I think both plans equally good, and I think would do equally good and efficient duty under any circumstances.

The CHAIRMAN: I think the meeting will join with me in giving their thanks to Mr. Hyde for his very able lecture upon this subject. It seems to me that he has gone as near as possible to the great object of keeping the shot out of the ship. With regard to the material, the only doubt that can be thrown upon this to my own mind, is that the material is stronger in proportion as it is smaller than it is on a great scale, but excepting that, it seems to me that these experiments are very conclusive. Certainly, they are very good as guides for larger experiments on a grand scale. I should think it would be very desirable to have experiments on the full-sized scale afterwards, before we could fully and entirely trust these means for ship-building. The only doubts I, as a sailor, have, are, that we have so many other problems to deal with when we go to sea, besides keeping the shot out of the ship, but as far as keeping the shot out of the ship goes, that, no doubt, can be tolerably accomplished with deflecting sides. You will I am sure, join with me in thanking Mr. Hyde.

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LECTURE.

Friday, March 12th, 1869.

General Sir WILLIAM J. CODRINGTON, G.C.B., in the Chair.

THE ESTABLISHMENT OF COUNTY MILITARY TRAINING SCHOOLS; A SUGGESTION FOR IMPROVING THE RECRUITING SYSTEM.

By W. Cave Thomas, Esq., late Captain 19th Middlesex Rifle Vols.

In this land of free opinion and debate, every State department is exposed to the criticism of any one who happens to magnify his interest in some political, ecclesiastical, military, or naval hobby into proof positive that he is specially entrusted with a reforming mission. This must appear to departmental eyes, and doubtless very often is, sheer presumption. But it is not State departments alone that are subjected to the criticism and dictation of amateurs. Art, science, literature, &c., are considered fair game for the critical shafts of churchmen, soldiers, sailors, and politicians. Aye! and in nine cases out of ten, the amateur critic will have the public with him, because his knowledge of the subject is nearer on a par with the ideas of the mass. The din from this *mêlée* of specially gifted critics keeps us all awake in our own proper professions, and though it may sometimes disturb and "rile," it often makes us laugh. There are several circumstances to tempt and favour the venturesome outside critic; the maxim, *surtout point de zèle*, though mysteriously but plainly posted up before official eyes, has neither terror nor deterring influence for him, and even if that spectral maxim were not a sufficient check upon the ardent official would-be-reformer, there is the weight of precedent, routine, and detail to overwhelm and smother suggestion at its birth. The foregoing remarks at least form the best plea I can offer for my temerity in addressing you upon a subject like the present—a subject with which it may possibly, and justly be said, I have no business. A too sanguine temperament may have invested the scheme I am about to submit to you, with an artificial glow of importance in my own mind; but there is this also to be said, that in mental aiming, as in rifle practice, the inexperienced sometimes hit the mark by a "fluke." It is just possible, therefore, I may not detain you in vain. I wish moreover to show you that painters are not, as recently asserted by a leading review, notoriously indifferent to public affairs.

It appears to me, that our first question with reference to any special branch of education in England, indeed of any special department, should be—Are our existing means the best that can possibly be devised for the special purpose? If not, it is our immediate duty to put aside any prejudice in favour of an existing order of things, and determine that they shall be.* To this end I do not think it safe at all times to follow those "reformers" who eternally exhort us to follow continental example; every nation has certain idiosyncracies, and all true reforms should in some measure be founded upon, and conformed to national characteristics.

The neighbours of a professedly military nation, maintaining an enormous standing Army, have but an alternative either to establish an equal and similar armament, or to make their whole populations partially military by a limited period of service; by the institution of the Landwehr, as in Prussia, or by the Militia and Volunteer systems, as in England. The Germans and Anglo-Saxons more peacefully and commercially inclined than some other races, are averse to being taxed to support vast standing armies; they only consent to do so under pressure, for defence, never willingly for defiance. For the more excitable and bellicose nations, the colossal standing-Army-system is perhaps a political necessity: for were these to attempt the adoption of the Prussian or English systems, it would only lead to internecine war. An excitable and combative people will fight either abroad or at home, unless perfectly under the control of a central power. The Landwehr is felt to be a great inconvenience and burden to the commercial classes in Prussia, but what would such an institution be to our own high-pressure trading community? The conscription, even, is not borne with a very good grace by a military people. We prefer, therefore, to maintain a moderate standing Army, and to trust in cases of emergency to the patriotism of our countrymen, to our Militia and Volunteers. Nevertheless, the English system has its inconveniences too, and we have on more than one occasion, found it difficult to expand and recruit the Army and Navy to meet an urgent call. My purpose in this lecture is to submit a plan to your notice, which I have thought, and I hope you will consider in some measure calculated to remedy these defects, to give more stability to our whole military system, and more organically to unite the Army, Militia, and Volunteers, at the same time indicating the means by which a certain measure of that promotion from the ranks, which is popularly looked forward to as a necessary condition of an ideal Army, may be gradually introduced without materially affecting vested interests. I say "*gradually* introduced," for we fortunately know in this country that any great change in either military, or other State affairs, is better thus than suddenly effected; and when the interval between the present and the future is bridged over by tentative measures and compromises. Nevertheless, this question cannot be lightly dismissed nor altogether "shirked," for the absence of any very obvious and recognizable element of promotion from the ranks will be fraught with more and more danger. The reason may not be obvious at first sight, but if we can possibly conceive a revolutionary spirit springing up in this country, the closed avenues to promotion would be the key to a successful attack upon the constituted order of things, to effect the disorganization of the State; for a party strong enough to agitate the question of promotion from the ranks, and to promise open competition, a fair field and no favour to soldier and sailor, would be able to spread disaffection in both services. We shall presently see other reasons why such an agitation might, under certain circumstances, be productive of dire results.

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* It was with this conviction that when, in 1851, the application of the surplus funds of the first Great Exhibition was under the consideration of the Royal Commissioners, I published a pamphlet, suggesting the establishment of a Great Central Polytechnic College at South Kensington, or some other convenient site, wherein every faculty of art, science, and literature should be represented by the best professional expositor to be obtained, either at home or abroad. This pamphlet contained lithographed plans of the theoretical arrangement of those Faculties in the proposed Central College, and of Primary Schools. Copies of it were forwarded to the noblemen and gentlemen composing that Commission. The military training schools are a portion of the entire scheme of education then conceived.—W.C.T.

We must recollect that our Armies have hitherto been chiefly composed of the crude uneducated soldier, having no aspirations beyond his immediate duties, and perfectly subjected by drill and discipline. But this staple of the old style of British force is gradually disappearing; it is daily becoming less and less possible, even were it expedient, to have again an Army composed of such human material. The staple "private" of former English Armies will be gradually displaced and supplanted by a man of a very different stamp, more educated, more thinking, more reasoning, who will require an altogether different mode of treatment, which, if foreseen and thoroughly understood, will secure a greater military efficiency, and enable our Armies to achieve even more astonishing results than heretofore. In a country where the masses are rapidly becoming informed, as well as supplied with increased material comforts, the unquestioning implicit obedience of the aboriginal soldier will have to be exacted by other means than by sheer despotic coercion; the new staple of our Armies will rate itself at a higher price, and recruiting will become more and more difficult, unless some greater and more tempting inducements than were formerly, can be proffered. The young men in humble life, who now lead more genial lives, are gradually being educated, and are becoming shrewd enough to inquire "why they should endure hardship and servitude for the inadequate rewards the recruiting sergeant, with all his glamour of colouring, can offer." These very men, however, would freely yield service and obedience if some of the drawbacks of barrack life could b mitigated, and the higher prizes of promotion were to be open to more general competition.

That the gradual change in the human material of our Armies is n mere rash speculation, no mere phantom of my brain, may be gathered from the following tables, derived from the fourth report of the Royal Commission on Army Schools.

Table No. 1 shows the state of education in the Army in 1868, and was deduced from returns, received from the Adjutant-General, of regiments and corps amounting to 169,214 men. The per centage in the last column is taken from the Council's Report of 1865.

This return does not include fourteen battalions of infantry from which no returns had then been received.

TABLE I.

	Number returned.	Per centage in 1868.	Per centage in 1866.	Per centage in 1865.
Class 1.—Who can neither read nor write	16,010	9·46	12·25	12·97
Class 2.—Who can read but not write	17,924	10·59	16·12	16·55
Class 3.—Who can read and write	124,893	73·80	65·47	63·67
Class 4.—Who have a superior education	10,387	6·14	6·16	6·80

Table No. 2 shows the proportion of "uneducated" among the several branches of the service, comprising under that term classes 1 and 2 of the above table (viz., those who can neither read nor write, or who can read but not write). The per centages in the last tw columns are taken from the Council's third report.

TABLE II.

Corps.	Classes 1 and 2, Uneducated.			
	1868.	1866.	1865.	1860.
Cavalry	10·90	19·13	19·78	22·08
Royal Artillery	18·30	20·42	19·41	25·65
Royal Engineers	1·34	3·17	3·34	5·36
Military Train	24·37	24·30	38·62	42·37
Foot Guards	8·12	8·66	10·06	10 96
Infantry of the Line	25·54	33·99	35·71	45·62

In Table No. 1 we observe a gradual diminution of the "uneducated" element, but in Table No. 2 the progress from 1860 to 1868 is ver marked. Now I think this educational improvement is not to be wholly attributed to the influence of the Army Schools, if we may judge from the following passages derived from the reports :—

Mr. Vicars, reporting from Ireland, "regrets that the average daily "attendance continues to bear an unfair and unsatisfactory proportion "to the number on the school books. On looking back to the return "of 1862 he found that the attendance was equal to something like "40½ per cent. of the number on the register, whilst in 1865 it was "only 30¼ per cent. Mr. Sargeant finds no improvement during the "past year (1865). He refers to a depôt battalion in which, after "deducting the attendance of the buglers, there remained 5,808 attendances to be divided between 384 men, giving an average of 15 "attendances per man during one half year. 167 of these men put in "from 1 to 5 attendances, only 25 of the 384 made attendances in "each of the six months, 'that is to say, all except 25 men were "absent during the whole month.' Colonel Maude reports from "Gibraltar that the general attendance of the adults, those of the "special classes excepted, has been irregular, the average attendance "of each adult being made two or three times a month. Special "reasons are adduced to account in some measure for irregularity of "attendance during the past year, but after making all due allowance, "the facts are not encouraging."

And again, "Colonel Romer at Malta is unable to make a satis"factory report on the attendance of the men." The great increase in the *educated* element during 1865, 1866, and 1868, is therefore more probably due to the advancing education of the masses. But whether the Army becomes an educated Army from internal or external causes, it will at the same time that it becomes a more effective one under proper treatment, become also a more thoughtful and reasoning one. These anticipations, therefore, justify the immediate suggestion and consideration of measures to meet the new state of things.

I am now, as when I first took an active part in the Volunteer movement, forcibly impressed with the conviction that the military training of a people, judiciously conducted and with the perfect understanding that, except upon any emergency occurring, it is to be considered in the light of a beneficial discipline and means of physical training, would prove one of the most effective educational means of raising and ennobling a people that could be devised. Can any one doubt that the great mass of the work of the country, whether of manufacture or agriculture, would be better done if workmen went through a good course of drill in the Militia or Volunteer ranks? But when I speak of workmen serving in the Militia, I propose that there should be a distinct branch of the Militia specially established for that purpose, which should be called the Reserve, and be subject to somewhat similar conditions with regard to pay and drill as the Militia, but that this branch of the forces should be immediately under the government of the War Department. This, too, is a measure which might be used to effect a gradual change in the entire Militia, if it were considered expedient to bring it by degrees under the immediate control of the central authority. I have considerable knowledge of the working men of this country, and feel confident that so far from mischief ensuing, considerable strength, as well as industrial advantage, would be gained by the commonwealth if they could be induced to join the proposed Reserve for a limited period of service. You will readily understand why, regarding as I do a certain amount of military training as an educational element, I should desire the Reserve to be a separate Institution fenced about with some degree of exclusiveness.

An old proverb tells us to "beware of playing with edged tools;" we know the value of the warning, and that readiness for, is to increase the probability of war, under certain conditions. But my faith in the temper of the English people leads me to believe that they can play with all the panoply of war without desiring to be hostile, to sharpen their swords, or to load with anything but blank cartridge, except upon great provocation.

I will turn, however, from these general and preparatory remarks to develop a scheme of County Military Training Schools, as a suggestion towards improving the recruiting system, the first sketch of which appeared in a letter addressed to the editor of the "Pall Mall Gazette," March 22, 1867. I use the title *county*, because being a familiarly recognized division of the kingdom, it gives at once a clear notion of the project, though it would doubtless be found more expedient in carrying out the project to equalize provincial disparities of area and population by a judicious division of the whole country into equable military districts. The following then is, with some slight modifications, the outline of the scheme proposed in the letter referred to.

1. That there be a Military Training School established in each county, which shall consist of three departments, the primary, the middle, and high schools.

2. *The Primary School.*—To be open to boys of humble birth, able to read and write, who being desirous of preparing themselves to enter the Army shall have their parents' consent. Term of service from 14 to 23 years of age, viz., from 14 to 17 in the training schools, from 17 to 20 in the Reserve, from 20 to 23 in the Army. This department to afford the means for improving the education of the lads who enter it, and for training them to industrial occupations useful in the Army. Drill would, of course, form a part of the daily routine. Promotions to be periodically made from the Primary to the Middle school.

3. *The Middle School.*—Open to the sons of yeomen and small tradesmen at an equitable annual charge to parents or guardians. The boys to be admitted on recommendation, if able to pass a moderate examination. The number of admissions to be regulated by authority. The lads entering this department to be educated for the Engineer Corps, and for the duties of Non-Commissioned Officers. Age of admission and term of service as in the Primary School. Payments by parents or guardians to cease on the pupils attaining the age of 17, the youths would then join the Reserve, and after passing through their term in that, enter the regular Army. Promotions to be periodically made to the High School. Promotions from either

of the schools should, perhaps, earn an extension of the educational term.

4. *The High School.*—For the sons of the wealthy; admission by competitive examination at 15 years of age. Number of admissions to be regulated by authority. The expenses of education and maintenance to be defrayed by parents or guardians. The education to be specially scientific, and include those subjects which would also be available in competitions for civil appointments. Competitions periodically to take place for commissions. Certificates or diplomas from this department should give preference to the holders in the purchase of commissions, and to candidates for the Reserve, Militia, or Volunteer appointments.

5. That Naval Schools, similarly constituted, be established at all the principal seaports.

6. That the buildings of the Primary, Middle, High Schools, and the head quarters of the Recruiting Staff for the district be in proximity; and that the schools be contiguous to a commodious parade ground. Each establishment of the kind to be located at some conveniently accessible point in the particular Military District.

Such then is the rough sketch of "the suggestions." I will now proceed to take each department seriatim, and endeavour to explain more fully its working and objects.

Further Development of the Scheme.

Primary School.—In my first sketch of the proposal in the "Pall Mall Gazette," it was not suggested that candidates for admission to this school should have to pass an examination, or should be subjected to any educational test; but the following passage from the Report on Army Schools changed my opinion on the subject, and induced me to add the condition, *that a moderate degree of proficiency in reading, writing, and arithmetic should be one of the necessary qualifications for admission.* The passage alluded to, refers to the school of the Royal Chelsea Asylum, and runs thus:—"Formerly no boys were admitted after 10 years of age. After the Crimean War the age was raised to 11 years, and last year it was raised to 12 years. As there is *no qualification required for admission*, many boys enter who are entirely ignorant of the rudiments of education, and *having grown up to this age in idleness and ignorance, it is most difficult to change their habits or cultivate their understandings.*" Other conditions should be, that they be free from bodily defect or infirmity, and that those who have charge of them, give *written consent*, that when of proper age they shall be placed with their own free consent as private soldiers in the regular Army.

I am inclined to suppose that these Primary Schools would be supplied with pupils to some considerable extent by the Grown Children's Army Schools, and *gradually obviate the present necessity for adult army schools*, a necessity which is beset with inconvenience. The following experience on the subject is extracted from the Reports:—"During the drill season it is impossible to get any large or regular "attendance of men at school.* Finding such to be the case, I have "for the last two years instituted a *special class*, who are excused certain duties, and by this means I trust in course of time to give "every man a certain amount of education." The institution of a *special class* is an example which I think might be advantageously followed in the conduct of the proposed schools. I will, therefore, again presently call your attention to this point of detail.

The proposed written consent of parents or guardians, just now mentioned, may not, at first sight, appear a very hopeful preliminary to recruiting. But the statistics of the Royal Chelsea Asylum and Royal Hibernian Military Schools, hold out the most encouraging prospect in this respect. The authorized establishment of boys at Chelsea Asylum is 500. The actual number on the 31st March was 499, of the following ages. Under ordinary circumstances they are not kept after 14.

Under 6 years	5
From 6 to 7 years	14
„ 7 to 8 „	23
„ 8 to 9 „	51
„ 9 to 10 „	54
„ 10 to 11 „	64
„ 11 to 12 „	89
„ 12 to 13 „	91
„ 13 to 14 „	92
„ 14 to 15 „	15
„ 15 to 16 „	1
	499

During the years 1861, 62, 63, 64, 65, and 66, there were of boys whose time had expired—

Fit for the Army	345
Unfit	67

269 volunteered for the Army, 5 remained as monitors, 119 were delivered to their friends. The proportion of those boys reported "fit," who volunteered for the Army was the same in 1865 as 1864, viz., 75 per cent. Of 521 children trained in the schools, and afterwards enlisted in the Army, 6 have by their conduct and talents raised themselves to the grade of Commissioned Officers. Less than 3 per cent. are classed as bad characters, and only 6 per cent. as indifferent.

From a return from the Royal Hibernian Military School, it would appear that of 81 boys whose time had expired during the twelve months ending the 31st March, 1866, 67 boys were reported fit for the Army, and that of these 49, or 73 per cent., enlisted for the Army, while 4 remained as monitors; 14 boys, or 17 per cent., were reported unfit for the Army, and of these 2 were appointed to trades.

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* See also the quotation at pages 15, 16, and 17.

ABSTRACT of the number of Boys formerly in the Royal Hibernian Military School, and serving in the Army on 1st January, 1866.

Rank.	Number in each Rank.	Character.	Number.
Officers	8	Exemplary	49
Bandmasters	7		
Sergeant-Majors	1		
Enlisted Schoolmasters	13	Very good	155
Quartermaster Sergeants	3		
Troop Sergeant-majors	1	Good	596
Colour Sergeants	16		
Trumpet and Drum-majors	12	Indifferent	39
Sergeants	40		
Orderly-room Clerk	1	Bad	16
Paymasters' Clerks	3		
Lance Sergeants	2	Very bad	4
Corporals	44		
Lance Corporals	14		
Bombardiers	17		
Musicians	677		
Drummers			
Gunners			
Sappers			
Privates and Boys			
Total	859		859

Canon Moseley considers that one-half the boys who leave the Chelsea Asylum have received a really good education. About one-third receive an education which he considers to be equal to that obtained by the best instructed boys of an ordinary national school. One-eighth or one-ninth are backward boys, whom it is difficult to teach, a class to be found in every school, but represented perhaps more numerously in other schools than here. About one-twentieth of the boys are of a class whom it is nearly impossible to teach—constitutionally dull, or incorrigibly idle.

If a certain per centage of the lads educated in the proposed military training schools had to be delivered over to their friends at the expiration of their school period, the education, discipline, drill, and industrial training received, might not be lost to the Army in some critical emergency, and would certainly be a gain to the community under any circumstances. With certificates of good conduct and such a training, they would be sought for as orderly and effective workers. It should also be made a point to impress upon the pupils of the primary schools, on joining the Reserve and Army, that, whether or not the opportunity should be presented to those holding a good school certificate of deriving material benefit from it whilst in the service, it would certainly be of use to them if coupled with a certificate of good conduct, when seeking employment after the completion of their period of service. I have no doubt after a few years such certificates would be found certain passports to employment in all offices of minor trust, in the constabulary, the railway and telegraph services, &c., &c. It would, indeed, be good policy to make them so. But perhaps you will think I am laying more stress than necessary on the civil destiny of the lads passing through the proposed schools; but if you reflect for a moment, you will perceive that the kind of training suggested for these schools would make "effectives" for many civil employments; the schools would have, on this account, an equal, if not stronger, claim to support upon the Educational, as upon the War Department. There would, therefore, be strong grounds for appealing to the former to contribute to the establishment and maintenance of one such school at least, in every county, for soliciting the consideration of the proposed military seminaries in any future scheme of general education: not that I imagine, with a well organized plan of industrial training, the expense of maintaining such institutions would be very great.

The statistics of the Royal Chelsea and Hibernian Schools, although sufficiently encouraging, must necessarily fail to give any adequate idea of the aid the proposed county military training schools would lend to recruiting the Army. The two model schools referred to, are only open to soldiers' orphans, who are admitted without any physical or educational qualification. But the county schools would be open to all comers physically qualified, able to read and write, and well recommended. The proposed schools would open, as it were, new gates to employment and promotion, which would soon become known in each district, and be regarded as promising openings to the lads of the industrial classes, as well as to the sons of soldiers. Let us, however, attempt some sort of speculative calculation as to the number of recruits the county military schools would send into the Army. Take the number of military districts at 85, equal to that of the counties in England, Scotland, and Wales, and let a hundred boys be annually admitted to each of the primary schools, commencing January 1st, 1870, then on the 1st of January, 1873, of the 25,500 lads in training, 8,500 (their school term having expired) would be transferred to the Reserve, the same number in 1874, 1875, and 1876, in all 34,000, and of course their vacancies supplied in the schools. But on the 1st January, 1876, 8,500 men being due to, would be passed from the Reserve to the regular Army, leaving 25,500; 8,500 men would also join the Army on January 1st, 1877, 1878, and 1879. On January 1st, 1879, however, 8,500 would complete their stipulated (first) term of service, and be entitled to their discharge. Thenceforward there would always be 25,500 boys in training, 25,500 recruits in the Reserve, and 25,500 men in the Army. These are results not to be despised, though made on an assumed quantity, which, I think, you will agree with me, might be increased in practice. The foregoing calculation, too, does not include the Officers and non-commissioned Officers who would be added to the Army by the middle and high schools, nor attempt to estimate the number of men to be derived from the other portion of the proposed Reserve force, which would be attached to that emanating from the schools for a certain number of days* during the drill season.

Three or four years' service in this division of the Reserve should exempt working men from further call for military service abroad; and to this branch the pensioners of the military school system would be returned.

I have only briefly alluded to an educational grant as probably affording the means to establish and maintain these schools; but I believe the nobility and gentry of the country, once convinced of their importance, would soon hasten to endow and render them independent of any other pecuniary aid.

I do not propose that any great extension of education in a literary direction should be the main feature of the primary schools, but that certain degree of instruction, which together with industrial training and regular drill, is calculated to make the intelligent, self-helpful, and generally useful soldier. But I would institute a *special class* for those lads who should display superior mental abilities, and, as in the Army schools, exempt those composing it at intervals from some of the more laborious duties. The objects of a *special class* will, perhaps, be better understood from the following extract from the report of Lieutenant-Colonel Gleig, who in reporting upon the 1st depôt battalion, where the education of the soldier is much encouraged, remarks, "The schoolmaster has his Commanding Officer's orders to send away "the least instructed for whom he may not have room, and to keep "for further instruction those who have already acquired some know-"ledge of the subjects usually taught. It is the Commanding Officer's "opinion, that *these*, and not the entirely illiterate, are the men whom "it is most to the interest of the service that the schoolmaster should "take in hand.†"

The school course should comprise :—

Religious instruction.
Arithmetic.
English history.
Geography.
Grammar.
Dictation.
Model drawing.
Vocal music.
Instrumental music.

Industrial training as—

Carpenters.
Smiths.
Wheelwrights.
Shoemakers.
Tailors.
Tentmakers.

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* These would be better distributed than twenty-one days together, as in the Militia: twenty-one days together would be quite out of the question for working men, for whom this portion of the force is designed.

† Fourth Report, 1866.

It would, perhaps, be inexpedient to carry on industrial training in all these crafts in one establishment; some might be practised in one district school, some in another. But I would suggest that there should be farm land attached to all the military schools, and that all hands in the lower schools should be employed at certain seasons in agricultural labours; the experience so obtained might render the lads at some time or other more useful as soldiers, and the time must come, perhaps is already come, when rifle, pick, and spade must journey together. A friend of mine thinks that the muzzle of the rifle should be contrived to alternate between spade and blade.

In suggesting the length of, and the divisions of the term of service, it is of course at a theoretical venture which would require modification and welding to the existing state of things, and conditions only applicable to men who may have passed through the County Military Schools. I am, however, intuitively inclined to favour short periods of service. The moderate term proposed, would enable men entering the Army to look forward to civil employments in the prime of life, in the event of their changing their military minds, and wishing to leave the Army. There is, however, the possibility, the probability, that many men would prefer remaining, and prolonging their term of service, if the conditions offered were to be made sufficiently favourable. To promote, to ensure such a result, I would propose that there should be two other terms of service, of three years each, in the regular Army, which would make the whole period from entering the schools to the soldier's final discharge, fifteen years. For each of these additional terms there should be a bounty, which should be paid at the soldier's option, either at the beginning or end of each term of fresh enlistment, and which, in case of a man falling or dying, during either of these periods of service, if not previously received, should be paid to his nearest relative. And further, that in case of payment of bounties being deferred till discharge, at the end of fifteen years, a soldier should have the option of receiving full payment of bounties, or a pension, but in case of choosing to be pensioned, the country to have a further claim upon him for service in the Reserve till the age of forty. If disabled in the service, the soldier to receive full pay of bounty or bounties and a pension. By such means, and by degrees, I believe, we should have not only a considerable and valuable force of thoroughly trained men in the ranks, but also a force of capital soldiers scattered through the land in civil employments, who would be sure, in larger or smaller numbers, to gravitate to the ranks again, in that collapse of industries which inevitably succeeds the declaration, and continues during the prosecution, of war.

The promotions to the middle school would, as a rule, perhaps, be made for that *special class* of lads displaying most capacity, and who, on that account, would have extra opportunities afforded them of acquiring knowledge. I must now pass on to the further consideration of the middle school.

Middle School.—In this department the course of instruction would have a wider range, its professed object being to prepare the lads for the Engineer corps, and as Non-Commissioned Officers. Here I quire more experience and knowledge of detail than I can possibly tend to, and will, therefore, only subjoin the time table of the ormal school of the Royal Chelsea Asylum, as probably suggesting n approximate notion of the kind of studies, and the time which hould be devoted to each.

EEKLY Distribution of Time in the Normal School of the Royal Asylum, Chelsea.

	1st Class.	2nd Class.
	Hours.	Hours.
Religious instruction	2	2
Writing papers on scriptural subjects ..	1½	1½
Mathematics.		
Arithmetic	1	2
Algebra	2	2
Euclid	1	2
Mechanics	1	0
Trigonometry	1	0
English history	2	2
Do. grammar	2	2
Reading	2	2
Geography	2	2
Fortification	2	2
Model drawing	3	3
Vocal music	4	4
Chemistry	2	2
Physics	2	2
Private study	7½	7½
Examination	2	2
Drill and gymnastics	6	6
Total	45	45

In the general drill which would take place daily, or at regular tervals, the lads of the middle school would take their relative ades as Non-Commissioned Officers.

The High School.—I propose that the course of study in this partment shall be entirely scientific, an exception being, perhaps, ade in favour of some of the modern languages, and should comise:—

Pure Mathematics.
Section 1.—Arithmetic.
Algebra.
Euclid.
Plane Trigonometry.

Section 2.—Spherical Trigonometry.
Elements of co-ordinate geometry
Differential calculus.
Integral calculus.

Mixed Mathematics.—Statics.
Dynamics.
Hydrostatics.
Modern geography.

Experimental Sciences.—Chemistry.
Heat.
Light.
Electricity.
Magnetism.

Natural Sciences.—Mineralogy.
Geology.
Free-hand drawing.
Geometrical drawing.
Permanent fortification.
Field fortification.

According to the plan suggested, the *general* educational attainments of the students of the high school would be tested by the examination for admission.

This would have the advantage of dividing the term of study into two periods, which I think would be a boon both to the tutors and tutored. The work of both periods would be easier done, better done, and more indelibly impressed upon the memory. Time should, of course, be set apart for *keeping up* the attainments of the first course. And commissions should be periodically awarded for excellence.

The course of study in the high school should be sufficiently comprehensive to enable men to pass examinations for any of the Government appointments, military or civil. Those special military subjects which would slightly extend the range of study of civilians, I think should be absolutely required of all candidates for colonial, if not for all important Government appointments. And a diploma, or permission to use the affix H.M.S. (High Military School) should give preference in all appointments to the Army, the Reserve, the Militia, or the Volunteers.

I would also suggest that the depôt battalion of some regiment be located in the neighbourhood, or at no great distance from the military school. To this depôt all the recruits of the district should be passed, so that a particular regiment would gradually be associated with a particular district, a condition which I believe would materially promote the general or open recruiting in that division of the country; and that men passing their first period in the Reserve, should, if qualified, and so desiring, be transferred to the Army before that period expire.

Not one of the least advantages of this system would be its applicability to the colonies. It would link together the home and colonial military organizations, and prepare an effective nucleus of a defensive force in each of our colonial possessions ready to be supplemented on emergency with troops from England, and possessing that local knowledge, the want of which so often leads to unnecessary sacrifice of life and to disaster.

In concluding the exposition of my scheme, it will perhaps assist you to grasp the proposal in its totality if I give a brief summary of its salient points. The County Military Training Schools are of course the basis of the system. The Primary Schools keeping up, according to the calculation adopted, and independently of any other source, 25,500 men in the Reserve, and 25,500 men in the Army. These men would, moreover, be skilled handicraftsmen in those special industries calculated to render an Army independent. Then there would be the Middle School, supplying the Engineer Corps and educated Non-commissioned Officers, whose numbers are not included in the estimated 25,500; if, however, we take 30 as the number of boys annually admitted to each of the schools in this department, that estimate would have to be increased to 28,000. Then there would be the High School, preparing men for commissions in all branches of the service for the Army, the Reserve, the Militia, and the Volunteers, and not only designed to give able men to the military but also to the civil service, for it is important with such extensive colonies, and comparatively so small an Army, that men holding civil appointments should have that amount of military education which would enable them in any case of rebellion to organize their countrymen, and the available resources of the station for defence, to the best advantage. The High Schools should in fact be seminaries where men should be prepared for important posts. The school-system, too, provides for the promotion of talent from the primary to the high department, so that every boy entering the lowest grade would know that the highest appointments would be open to him, should he display the requisite ability. The scheme also suggests the associating, the identifying a regiment with a particular military district and its training schools, the depôt of that regiment being near the military schools of the district, and the head-quarters of the Reserve as well as of the recruiting staff and depôt battalion. This is looked forward to as eminently calculated to promote recruiting in the district, and to develop an *esprit de corps* not likely to be so well fostered by any other means. To all these advantages superadd that of an Army of thoroughly trained soldiers scattered through the land in civil employments, on account of the moderate term of service, who would stand the country in good stead in case of invasion, and who might not be proof against a good bounty in other cases of need. There is also the proposed extension of the system of Military Schools to the colonies, more especially to those of Canada, Australia, and New Zealand, which would link together the home and colonial military administrations. It is also proposed, under certain contingencies, that the boys from the Primary Schools shall be passed annually to the Reserve, and from the Reserve to the Army, so as to rapidly increase the strength of the latter, and from this source alone, to 100,000 men. Finally I have to mention that branch of the Reserve which would be open to working men for a limited period of home service: the conditions would be similar to those of the Militia, but the drill days distributed over the year, so as not to interfere with their industrial occupations. The institution of this branch of the Reserve would, I think, offer a more acceptable form of service to the artisan than that of Volunteering or the Militia. To this branch the pensioners of the school system would be returned, and from it many recruits would doubtless be sent up to the Army.

Such, then, are the means by which it is surmised we might gradually establish a common educational bond between the forces of the Empire, calculated to secure unity of action, means which, whatever you may think of their numerical results to recruiting, you will perhaps admit would materially augment the *morale* and general efficiency of the Army, promise to give that intelligence, smartness, and self-helpfulness which make an Army, and gradually convert the *disjecta membra* of our military strength into an organized arterial system. Moreover, that the proposed reform, though calculated to mitigate class distinctions, is sufficiently conformed to the present constitution of the State as to assimilate itself with those social demarcations which have become a national characteristic most difficult to modify, not to say subvert.

ADDENDA.

The authorized establishment of boys at Chelsea Asylum is 500. The actual number on the 31st March, 1866, was 499. The boys are received between the ages of 5 and 10, and under ordinary circumstances they are not kept after 14.

The elder boys are instructed either in music or trades, the distribution being at present as follows:—

Musicians	91
Drummers and Fifers	62
Tailors	92
Shoemakers	85

The following table shows the number of boys who have been discharged from the Asylum since 31st December, 1860:—

Years.	Number of Boys whose time expired.				Number of Boys reported fit for the Army.		
	Average strength.	Fit for Army.	Unfit.	Total.	Volunteered for Army.	Remained as Monitors.	Delivered to their friends.
1861	410	42	4	46	39	..	6
1862	410	65	11	76	52	3	19
1863	410	92	11	103	77	1	24
1864 (1st Jan. to 31st Dec.) ..	497	69	20	89	43	1	45
1865 (1st Jan. to 31st March)..	497	14	6	20	12	..	8
1865 1866 (1st April to 31st March)	496	63	15	78	46	..	17
Total	..	345	67	412	269	5	119

The proportion of those boys reported fit who volunteered for the Army remains the same as in 1864-65, being 73 per cent.

The following table is an epitome of a return drawn up from reports received from the several regiments to which the boys of the institution have volunteered. Of 521 children trained in the schools, and afterwards enlisted in the Army, 6 have by their conduct and talents raised themselves to the grade of Commissioned Officers. Less than 3 per cent. are classed as bad characters, and only 6 per cent. as indifferent.

Rank.		Character.	
Officers	6	Exemplary	28
Staff-Sergeants	2	Very good	149
Colour-Sergeants	5	Good	304
Bandmasters	2	Indifferent	31
Sergeants	35	Bad	12
Drum and Trumpet Majors	10	Very bad	—
Corporals and Bombardiers	42		
Drummers	164		
Privates	255		
Total	521	Total	521

Evening Meeting.

Monday, March 22nd, 1869.

MAJOR-GENERAL THE HON. JAMES LINDSAY, Inspector-General of Reserve Forces, in the Chair.

NAMES of MEMBERS who joined the Institution between the 15th and 22nd March, 1869.

LIFE.

Wilson, A. K., Lieut. R.N. 9*l*.

ANNUAL.

Roberts, H. B., Major Royal Marine Artillery. 1*l*.
Hamilton, C. E., Lieut.-Colonel 80th Lancashire Rifle Vols. 1*l*.
Campbell, F. Lorn, Lieut. Scots Fusil. Guards. 1*l*.
Kennedy, A. F., Comdr. R.N. 1*l*.
Montgomery, W. E., Lieut. Scots Fusil. Guards. 1*l*.
Teschemaker, T. R., Major (h.-p.) R.A. 1*l*.
Fitz-Gerald, J. P., Lieut. North Cork Rifles Militia. 1*l*.

OUR RESERVE FORCES.

A paper prepared by Lieutenant-Colonel MALET, Grenadier Guards; and read by SIR ALEXANDER MALET, Bart., K.C.B.

The CHAIRMAN: I have now the pleasing duty of introducing to the meeting Sir Alexander Malet, who is kind enough to read a paper prepared by his son, Lieutenant-Colonel Malet, on "Our Reserve Forces," which, being a subject at the present moment engaging a great amount of public attention, and also a subject to be almost immediately brought before Parliament, when they go into the next Army estimates, I am sure will be received here with all that attention which it deserves, and to which the ability of its author fairly entitles it.

Sir ALEXANDER MALET: The Chairman and meeting will perhaps permit me to explain in a very few words how I am here, civilian as

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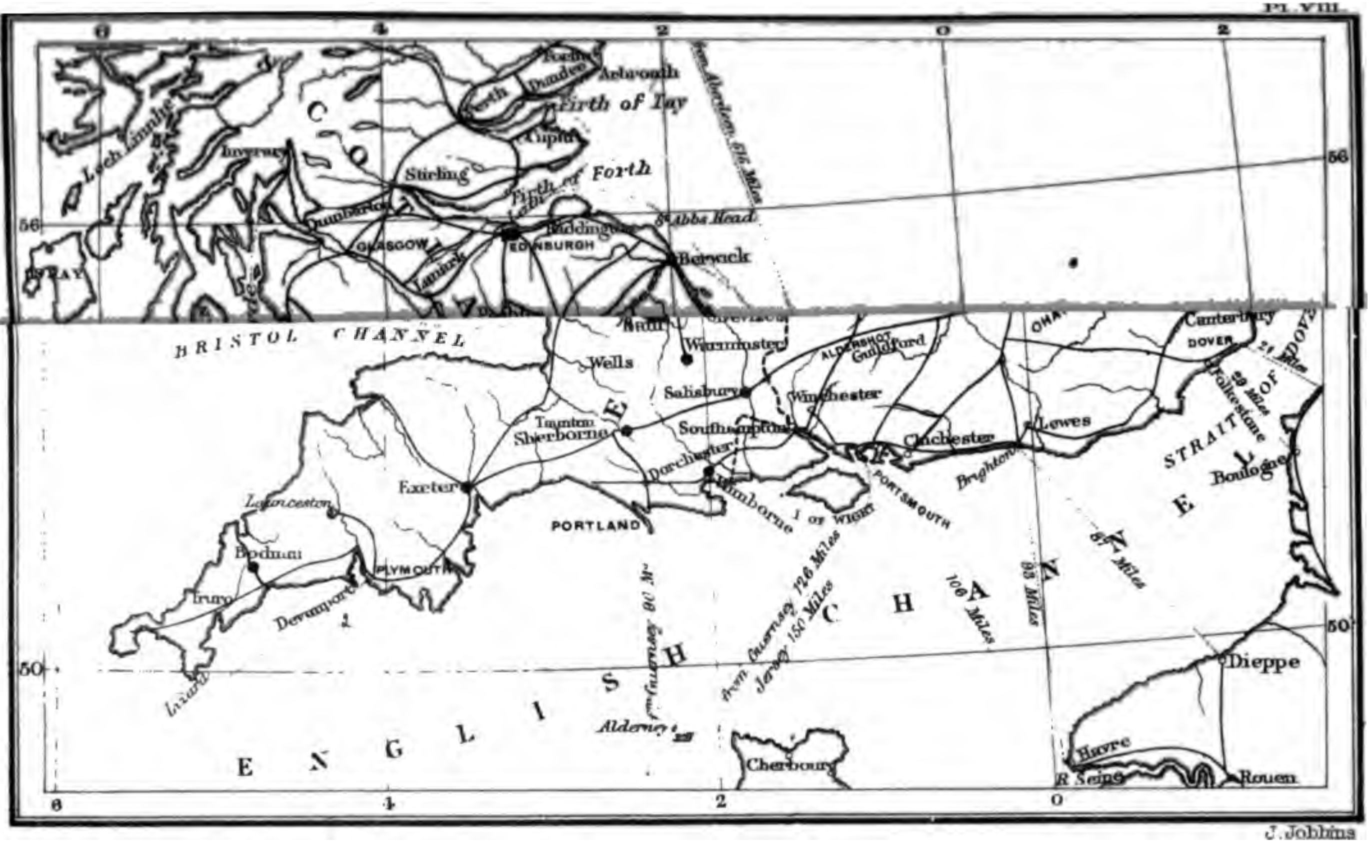

J. Jobbins

I am, as a reader of a military paper. My son, who prepared it, was abroad at the time when I gave notice to read it at a meeting of the Society of Arts, where, as you are aware, the subject of our Army reformation or re-organization has been brought forward by Mr. Henry Cole; but the matter brought forward was of such length that I did not find room for reading the paper, and I thought it would be more properly read at a meeting of the members of this Institution, where it would also be more likely to be appreciated. I have, however, only one difficulty, viz., that, though the father of the gentleman who wrote the paper, I am not the father of the writing, and that probably I should be unequal to defend the thesis; but as my son has returned, and is, I am happy to say, now present, I have no doubt that, if it is attacked, he will be able to fight his own battle and defend his own positions. I will now, with your permission, read the paper.

An English gentleman was once asked by a foreign Staff-officer, "How many transports do you suppose it would require to convey an invading army to your shores?" Our countryman replied, with perfect candour, "I do not know, but would undertake to send home the survivors in one." Most of us fondly cling to the above condensed estimate of the ultimate fate of an invader, but some impatient spirits would like to see a fair prospect of such a satisfactory result being achieved, say in a fortnight's time, after the landing of the enemy—and these dissatisfied people assert that, as we have in round numbers about three hundred thousand Militia, Yeomanry, and Volunteers in this island—a force certain to double itself on the least symptom of real danger—it is a pity that there should be a chance of a campaign on our territories being extended over a period of three or four months for want of a little timely organization on our part.

Those who advocate the adoption of a grand military system for our reserve forces, are begging no question in assuming that an invasion of England is possible. The existence of the Volunteers proves that the nation at large believes that a certain combination of events might lead to this result. The Volunteers are well aware of their own shortcomings, and demand a proper organization at the hands of Government; but as yet we have heard of no plan emanating from the War Office calculated to give cohesion and efficiency to the heterogeneous elements which we dignify with the name of the "Reserve Army" of Great Britain.

Given, a war declared between England and a continental power, France, for instance, after a sudden and brief dispute—France, with over 1,200,000 well-equipped soldiers, has really an *embarras de choix* for our annoyance. Mistress of the maritime base, "Marseilles, Toulon," she lands a *corps d'armée* in Egypt, and cuts off our communications with India, before we can so much as re-inforce the Malta garrison. Her cruizers land stores, arms, and possibly men to foment disaffection in Ireland. We awake to learn that the population of Lower Canada have not yet forgotten that they are of French origin, and at the same time we find ourselves threatened in the very heart of our empire. Let such a power have but one European ally, and this danger is magnified to an indefinite extent. Should we fail to take the initiative in the occupation of Belgium, she and her ally will make short work of gobbling up the little territory, while a third power comforts herself with Holland, and we shall have the satisfaction of seeing Antwerp and the Scheldt included in the hostile base of operations against our shores. Ireland would require plenty of troops; all our colonial garrisons would be screaming for reinforcements. If we could throw 30,000 men into Belgium, it would be a severe strain upon our resources.

Let us, then, consider what, under present circumstances, would be our method for utilizing the reserves of Yeomanry, Volunteers, and Militia. As usual, we should begin by robbing Peter to pay Paul. All or nearly all our Militia would be at once embodied, and as soon as each battalion had attained a respectable degree of efficiency, it would be broken up and its Officers disheartened by seeing all their best men drafted into the line. Last year we were promised by the Minister at War a Reserve for the Regular Army of 30,000 men, to serve in war under the same conditions as the line. If we had them they would for a time stave off the depletion of the Militia; but where they are, no one knows. Of course there would be a vast deal of drumming and fifing among the Volunteers; "each Yeoman would draw his battle blade," and the ranks of every corps would be filled to overflowing—in three weeks we should have at least 400,000 men under arms, but how organized? how commanded?

Shall we see each Lord Lieutenant like a baron of old leading his contingent to the war? Will Dorset follow Lord Shaftesbury? and Lancashire cry "Sefton to the rescue!"? What will be the destination of all those picturesque little detachments of light-horse Volunteers who appear by twenties and thirties, in various uniforms, at all Volunteer reviews? There are about 1,300 of them in all, but how are they to be united? Where are the knapsacks and Snider rifles for the infantry?—the horses, waggons, and rifled guns for the artillery? Will the Yeomen be brigaded according to modern theories, or will they act every regiment for its own county in independent glory? Where are the magazines for such an army as might be required to take the field? Where is its train? What system will be followed in supplying the troops with their first and second reserves of ammunition? Is there any field hospital corps? And last, not least, what is to be the administration of this great mass of men? Where is its staff? Will it be formed into corps, divisions, and brigades? Where are the various departments? To all these queries, echo answers alternately "How!" and "Where!"

Does any sane man in England believe that these matters could be put on a proper footing in a few weeks or perhaps days amid the confusion and anxiety of apprehended invasion? The resources of Woolwich—our one great military arsenal—would no more than suffice to supply the needs of the Regular Army, and our garrisons spread over the surface of the earth. As for the staff and administration, it is sheer imbecility to suppose that a system will rise out of chaos at our need. Yet we put off, and hesitate, when a little forethought, and a moderate expenditure, would insure us against the possibility of a disgraceful disaster.*

No one who will honestly contemplate the necessities of modern war, can doubt that what the country really requires, is a complete reform of our existing military institutions. So far as it goes, the Regular Army of Great Britain is one of the best—if not the best—in the world. Those who believe that all improvements are comprised in doing away with the purchase system, do not know where to begin or where to end. It is certain that an Army, including Reserves, of 800,000 or 900,000 men, such as we ought to possess, cannot be officered on that system; but till we have something better, it may be as well to leave untouched the old-fashioned machinery which for more than two centuries has given us a corps of Officers good and sufficient for their work. Grant that our leaders did not display extraordinary generalship in the Crimea, yet our cruel disasters were the result of one simple cause—we had no Reserves. *Without a conscription we never shall have Reserves properly called;* but reforms, and, above all, military reforms, make but slow progress in a country like ours, which has been so long without enduring the miseries of war.

Sooner or later, the nation will demand a conscription carrying with it a short time of service in the ranks and successive grades in a first and second reserve.

All men of the military age are morally as much bound to serve the State in war, as to obey its laws; but to serve it efficiently they must have learnt discipline and the use of arms, not as Volunteers only, but, as on the Continent, in the ranks. An English Volunteer is at least as much of a military monster as a Field Officer who has purchased his commission.

Pending the time when reason or misfortune shall have roused the nation to a sense of its shortcomings, let us consider the best that can be done with what we are pleased to style our "Reserve forces."

The existing military districts with head-quarters at London, Manchester, Dover, Portsmouth, Devonport, Colchester, Woolwich, Chatham, and Edinburgh, were constituted with a view to requirements totally different from those which have sprung up with the formation of Volunteer corps.

As Woolwich and Chatham are the nurseries of the two scientific services of artillery and engineers, they ought each to remain under the immediate command of a general Officer charged with the administration of his peculiar branch of the service, but subordinate to and included in the first corps of the Southern Army, as presently to be specified.

Let us suppose the remaining seven districts as abrogated or reformed, and in their place, the island of Great Britain divided into three grand military departments, each of these divisions into two sub-departments, and each sub-department, as area, population, and geographical position may require, into districts and sub-districts, without reference to county boundaries.

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* Those who doubt the necessity of previous organization are invited to study the unhappy campaign of the 8th Federal Corps, under Prince Alexander of Hesse, in 1866.

We presume that the regular troops quartered in each sub-department would be *pro tem.* under the command of its military chiefs in the same way as they are at present under the generals of the various districts within which they may be stationed. The only administrative difference between them and the Reserve troops would be that they are always under arms, and not being localized, they may in time of peace be transferred from one quarter to another as at present. They and the various Reserve corps resident in each department compose an Army, comprising two *corps d'armée*, each with fixed head-quarters and separate administration, responsible in time of peace to the War Office for the efficiency of the *personnel* and *matériel* under its charge, and capable of development at any moment into the working staff of an Army in the field. The first and second sub-departments of each grand department represent territorially the first and second corps of each grand Army—districts and sub-districts, the divisions and brigades of reserve corps respectively. This further division into districts and sub-districts has no reference to regular troops, because, as before said, they are not and cannot be localized. It is not necessary that the different *corps d'armée* should be of equal strength, but it is of the highest importance that the great principles which ought to govern the relative proportions of the various arms should be laid down and regulated by Government.

At present we shall find in one county a glut of artillery and a scarcity of riflemen, or plenty of infantry and no artillery; in some parts of the country there are several squadrons of yeomanry, in others, none at all; and so on *ad infinitum*. All these disparities are false distributions of power, and should be promptly reformed by superior authority. The Volunteers are perfectly ready to conform to the dictates of an intelligent administration.

The proposed territorial divisions would then be as follows:—Army of the south, first sub-department, first corps, head-quarters London: counties of Kent, Essex, Hertfordshire, Buckingham, Oxon, Berkshire, Middlesex, Surrey, Sussex, Hampshire, and Isle of Wight. Second sub-department, second corps, head-quarters Bath: counties of Wiltshire, Gloucester, Monmouth, Glamorgan, Carmarthen, Hereford, Pembroke, Brecon, Dorset, Worcester, Somerset, Devon, and Cornwall. Midland army, first sub-department, first corps, head-quarters Cambridge: counties of Suffolk, Norfolk, Lincoln, Cambridge, Nottingham, Northampton, Leicester, Rutland, and Warwick. Second sub-department, second corps, head-quarters, Shrewsbury: counties of Derby, Cheshire, Flint, Denbigh, Carnarvon, Anglesea, Stafford, Salop, Montgomery, Merioneth, Radnor, Cardigan. Army of the north, first sub-department, first corps, head-quarters, Edinburgh: the Kingdom of Scotland and islands. Second sub-department, second corps, head-quarters York: counties of Northumberland, Durham, York, Cumberland, Westmorland, Lancashire, Isle of Man.

The subdiv [illegible] these departments into districts and sub-districts, [illegible] division [illegible] ade head-quarters *for the reserves*, can only be made after careful consideration of the geography, population, and strategical conditions of the country, and does not come within the scope of a paper, which seeks only to arrive at certain general principles. It is sufficient to say that they must be selected with an eye to the concentration of men and the distribution of the material of war; and the head-quarters should be, as a rule, at the junction of two or more lines of railway. In the second sub-department of the southern army, such places as Carmarthen, Swansea, Launceston, Bodmin, Bristol, Exeter, Gloucester, Sherborne, Stroud, Wimborne, Warminster, Salisbury, Swindon, and others, seem designated by their position as points of *rendezvous* for the various corps preparatory to their union as an army. Should experience prove them to be so adapted, they would become brigade and divisional head-quarters, and the military capitals of districts and sub-districts.

On the danger of war becoming imminent, each of the three grand armies will receive a Commander-in-Chief and Staff, chosen by the Minister at War. The staff of the six sub-departments will be of limited numbers in time of peace, but permanent and most carefully selected; as on their industry and intelligence will depend the efficiency of the various divisions for war.

Each of these six head-quarter staffs will consist of a Lieutenant or Major-General of the regular Army, as Commandant, one Aide-de-Camp, an Assistant Adjutant-General and his Deputy, an Assistant-Quartermaster-General and his Deputy, a Colonel on the Staff as Chief of Artillery, a Principal Medical Officer, and at least one Staff-Surgeon, charged with the organization of the medical department of the Corps, an Officer of the Commissariat, with a due proportion of clerks, and one or two experienced officers of the military train, to form from the local resources of the country the germ of a sufficient Army Supply train.*

The brigade and divisional commands of reserve troops would be held, as in the Army, for five years; in time of peace carrying half pay. They should be bestowed, by selection of the War Office, on Officers resident in or connected with the district in which their commands are situated, who have served in the regular Army.† Their Staff should be in abeyance in time of peace; and appointed by the Corps Commander, subject to the approval of the War Office, on the first symptom of approaching hostilities.

It has been said above that no inconvenience is likely to arise from an inequality in the size of the various corps, but the importance of fixing the proportion of the various arms each to each cannot be overrated. These proportions, according to received authorities, appear to be about as follows in an Army of 51,000 men, viz.: 52 battalions = 35,000 men, 42 squadrons = 6,500 men, 24 batteries, 5 of which ought to be horse artillery = 144 guns = 4,000 men; engineers 1,500 men; add staff, waggon train, hospital corps, telegraph department, &c. =

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* To this estimate must be added, of course, the necessary divisional and brigade staff of any regular troops quartered in the department, as at Aldershot, Colchester, Dover, &c.

† These General Officers would replace the existing Inspectors of Volunteers.

4,000 men, and we have a grand total of 51,000 of all arms in this estimate. The waggon train will be a small one, as a great part of the Army stores will be moved by rail. Now we have in England and Wales 94 battalions of Militia, in Scotland 11, and of Rifle Volunteers in England and Wales 150 battalions, in Scotland there are 46, giving 301 battalions as against 138 squadrons, assuming each regiment of Yeomanry to consist of three squadrons. As for the Artillery, it is extremely difficult with the data at my disposal to arrive at any result. Of Militia Artillery we have about 94 batteries, all fit for garrison duties only, at least they neither have nor have ever had field-pieces. Of Artillery Volunteers we appear to possess about 350 batteries in England, Wales, and Scotland; that is on the assumption that each Captain in the Volunteer Artillery list represents a battery commander; but of these corps only a very small proportion are trained or provided with field-guns—none of them, to my knowledge, are in possession of rifled pieces. No force, however, is so difficult to improvise as an efficient field artillery. Of Engineers we have 62 companies, in what state of efficiency it is impossible for me to say; of military train and hospital corps—so requisite for the welfare of an Army in campaign—we have among the Volunteers no vestige.

Assuming that the above proportions for the various arms in a body of 50,000 men are approximately correct, it is obvious that the duty of Government would be to prune the exuberance of certain arms in some parts of the country, and to foster their development in others. If a working Army is ever to be formed, the field batteries will require the most careful and anxious supervision: the men should receive an increased capitation grant, and be assembled for training for two months in each year.

Here I am met by the allegation that it is impossible for Volunteers to acquire such a cohesion and knowledge of their duties as to become an efficient field artillery. My reply is that 400,000 reserve troops must have a due proportion of artillery; that the regular establishment is totally inadequate to meet such a demand; and that the nation which encourages the services of these men is bound to arm and instruct them efficiently. Supposing the three grand Armies to be mobilized, and to consist of 100,000 men each, their proportion of artillery is 900 guns; how much can Woolwich do towards supplying this number horsed and manned? We cannot blow hot and cold; either the Volunteers are useless, and had better be disbanded, or they are necessary to the national safety: if the latter, we are bound to place them, as regards armament, on a footing with regular troops.

I admit that a Volunteer artillery will be greatly inferior to that of the regular Army, but it will be better than none at all: and a little liberality, a certain allowance of instructors, and horses, say for two guns, and their proportion of waggons per battery allowed to be hired during two of the summer months at the expense of the country, would do wonders towards improving the force.

At least half of the existing force of artillery would be required for coast and garrison batteries: the remainder ought as soon as possible to be supplied with muzzle-loading rifled guns; each battery so supplied ought, if possible, to be kept in a barrack or Government store; but the battery Commander should be held responsible for the serviceable condition of his guns and harness. Evidently in assuring the due distribution and harmonious working of a reserve *Corps d'armée*, its Staff Officers will have a fine field for the display of their energy and talent. The Staff college, or a succursal thereof, should be open to Officers of Militia, Yeomanry, and Volunteers, under the same conditions as to Officers of the Army. As the troops of the Reserve must of necessity be in some respects inferior to regular soldiers, it is the more essential that their leaders should be well grounded in military science.

Each corps should have its permanent depôt established in the vicinity of its head-quarters: here should be kept its pontoon train, engineers' park, camp equipage, hospital implements, field-guns and small-arm ammunition, and, above all, a certain quantity of waggons and harness under proper charge, as a nucleus for the material of a military train, to be supplemented by taking the country carts on requisition when necessary.

All commissions should emanate from the Crown.

The ill-defined and useless jurisdiction of the Lords Lieutenants in local military matters should cease.

Uniformity of dress among the Volunteers should be inculcated; and by degrees, and with a due regard to sparing the men useless expense, insisted upon.

For administrative purposes the various scattered companies of Volunteers should be known only as companies A, B, C, D, of such and such a battalion, and battalions numbered in each grand Army, as for instance, company B, 12th battalion southern Army. As the Militia and Yeomanry probably cling with some prejudice to their territorial designation, it may be good policy to permit their retention.

Every battery, cavalry regiment, and battalion must be inspected twice a year by the corps Commander.

All waggoners and carters should be encouraged to join a Volunteer waggon corps.

Every volunteer should be served out with a knapsack, water-bottle, and havresack; he should be in possession of a great coat, and be made to parade in heavy marching order once a month. All the infantry should be supplied with breech-loading rifles. Every horse in every parish should be borne on a register, corrected half-yearly, and furnished by the district tax-gatherers to the corps head-quarters. The same regulations apply to all carts and waggons.

Each battery, battalion, and squadron should have its brigade or divisional rendezvous permanently assigned, and should proceed thither on receiving the route after the mobilization of the corps has been decided on.

Now taking the second corps of the southern Army, and supposing it to be organized on the principles which I have so briefly and imperfectly sketched, let us observe the process of mobilization, and endeavour to arrive at a conclusion as to the amount of time requisite for having the whole mass of troops assembled by divisions, and ready to move on any given point.

On Saturday, May 31st, Her Majesty in Council decides on mobilizing the southern Army. Lieutenant-General A. B. is appointed to the command: he fixes his head-quarters in London, and occupies himself with the formation of his staff. The War Office sends down an increase of staff sufficient to each corps Commander. At mid-day, on Sunday, June the 1st, the necessary warrants and instructions are in the hands of Major-General Y. Z., commanding the second corps: he at once telegraphs to all brigade and divisional Commanders to proceed to their respective head-quarters; also orders all brigade and divisional Staff-Officers, who have been already selected, on the first apprehension of hostilities, to join their immediate chiefs. By midnight on Monday the 2nd, all are at their posts. Traffic is suspended on the railways, except under the special permission of the Quartermaster-General. The Yeomanry are united by squadrons, the Infantry by battalions, the field artillery by batteries at sundown on Tuesday. On Wednesday, the Captains of field batteries, and Officers of the train and commissariat, duly furnished with requisitions, proceed to lay hands on all waggons and horses necessary to complete the equipment of their several departments.

As fast as the train is organized, the waggons are directed in due proportion upon the divisional points of concentration. Strong fatigue-parties are told off to every railway junction to assist in loading and unloading stores.

A Provost-Marshal is appointed, with deputies to each division.

By the time the necessary distribution and accumulation of supplies is effected, and the battery and train-horses got into something like working order, it is Monday the 8th: on that night Major-General Y. Z., having received satisfactory reports from all sides, orders the concentration by divisions or brigades to begin; for this and the formation of the various camps or cantonments we allow till Thursday. Friday, Saturday, Sunday, and Monday are devoted by the corps Commander to a personal visit to each division and brigade; and on Tuesday the 16th, he telegraphs to General Sir A. B. that his corps is échelonned in divisions, fully supplied with all requisites, and ready to move as may be directed.

This is no exaggerated picture of what may be done in a country of such vast resources as Great Britain, permeated by railways in every direction: supposing the system to be applied simultaneously to each corps, we have in sixteen days 300,000 men ready to take the field.

The advantages claimed for this plan are—Firstly, that it leaves the regular troops disposable for foreign service; and as in war the best system of defence is one which combines itself with offensive operations, the benefit is obvious. Secondly, it lies at the option of the Crown to mobilize only one or two corps, or only certain divisions or regiments in each department, as may be deemed best, without impairing the working efficiency of the remainder. Thirdly, that the expense of keeping up a permanent nucleus of staff and war material for each corps will be more than repaid to the country in the sense of security engendered by our being in a measure prepared for the extremities of war. Lastly, that the proposed territorial division of the island is an inexpensive alteration rather than an expansion of our present administrative system.

The Chairman: After having heard so admirably read and so well expressed a paper, I trust we shall have a good discussion on the merits of the proposals which you have now placed before you. We shall be happy to hear any gentlemen who may be pleased to make any remarks upon that subject.

Colonel Alcock, Commandant Rl. East Middlesex Militia: Mr. Chairman—As you have invited discussion, I will venture to say a few words, although as I know the author is ready to fight his own battle and to defend his own positions, it is perhaps rather a hazardous thing to do. I attended to the excellent paper which has just been read; the points which attracted my attention I take the liberty of noticing merely as subject for discussion, namely, those of the necessity for forming *corps d'armée*, and the necessity for conscription to supply them with men. With respect to the advantage of *corps d'armée*, there can be no doubt whatever that Colonel Lecomte, in his excellent historical work, which is in our library, gives his decision in favour of them. He says in the time of peace it is the most rational organization, although in time of war it does not give absolute superiority, inasmuch as in the last campaign the only *corps d'armée* improvised and mixed, was that of General Falkenstein, and this effected some of the most dashing exploits of the war. With respect to the conscription, that is rather a larger subject, because everybody knows that the Continental powers have 5,500,000 men, either actually under arms, or ready to be put under arms, and all those nations have their different peculiarities, characteristics, and military ability of different kinds. Well, of course, the effect of that organization is that the preparation for war is more expensive than war itself, and although it may not seem quite clear at first, upon consideration it will be evident that as the preparation is continuous, and the war itself may be brief, the preparation for the war is actually more expensive than the war itself; and as our system is a defensive and not an aggressive system, it follows that our system being continuous, must not be expensive. I think that is quite clear; but the advice given to us by Mr. Cole in his lecture, I have reason to suspect was rather too favourable with respect to Switzerland. As far as I recollect, he stated that it came to 10s. a man. Since that I have received a letter from Switzerland, in which I find far from that being the case, that the population of Switzerland is 2,000,000, and that it has a militia of 200,000, costing the country £355,525, or about £1 14s. per man, or 2s. per head of the population.[*] I take the liberty of mentioning that, because as all these matters turn on economy, it will be giving rather a false idea to suppose that even the Swiss can do what Mr. Cole believes to be the fact. He assumes that with this inexpensive arrangement they have always been able to hold their own, but my belief is (those who are acquainted with history know better than myself) that there are several instances—1799, I think, 1803 and 1815, perhaps, when they did not altogether hold their own. However, returning to the subject of conscription, or a modification of conscription, for of course our means of defence or preparation for defence must be based upon our customs, our antecedents, and our national character; therefore, instead of conscription, if I might mention the ballot, I think I could show that the ballot might be introduced without being either oppressive or inconvenient in any manner whatever. It is generally supposed that the ballot is of the same nature as a conscription in which the person drawn is to give his services. Now it so happens that the arrangement that took place when the ballot was in force, and which I believe is legal by the Act of George III, was that militia clubs were formed. They were called militia clubs, and were formed of a certain number of men who were liable to be drawn by the ballot—say ten men.

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[*] I am informed, besides this, that Switzerland has contracted a loan of £180,000 for the transformation of its rifles on the Peabody system.—T. St. L. A.

The calculation was that one of these would be drawn every five years. Well, these men subscribed, according to the rate a substitute would cost, perhaps, a shilling a head every week, till the required sum was in the club. At present it would probably be 3*d.* a week per head. The effect of that was, that the club of these ten men having subscribed the sum, say 1*s.* a week for 13 weeks, would make £6 10*s.* altogether, and having raised that sum, the price of a substitute if one of the men is drawn, they put the money to the stock purse of the regiment; the regiment goes on always recruiting, as it did before; there is nobody distressed. The thing is extremely simple if its working is understood, because it only amounts to a tax upon those men who do not actually serve, and the class of men who are taken and paid for according to the price of labour in the labour-market—those are the very men whom it is valuable to get, because they are men who go ultimately to the Army, and finally are ready for foreign service. That is exactly the thing which we do require. My own idea is—perhaps I may be wrong—that it would be exceedingly easy to introduce a ballot by degrees. Inasmuch as all the militia regiments have an excellent staff, adjutants and everything ready, there is no difficulty in it whatever, whereas at present not only you do not accommodate the time of service to the requirements of the labourer, but you actually draw the line so hard that you cannot have in a militia regiment any single man who cannot give 28 consecutive days to training, and therefore you actually exclude the very man that you want. Every man in a militia regiment who has been trained, and who from his good character gets a situation, will purchase his discharge, or leave the regiment. Now that man ought to have been retained. It is self-evident that having drilled the man, he being valuable, you should retain him, although he cannot give the 28 consecutive days' training which is required by law as it at present stands. I do not like to venture farther upon the subject, for fear of raising, perhaps, some hostile objection to my views, but I think it is a very fit subject to be discussed in this Institution; seeing the colossal preparations for attack that are made by other countries, it is quite right that in this Institution we should discuss what would be adequate and proportionate means for the defence of our own.

Sir Harry VERNEY, Bart., M.P.: Mr. Chairman—I came to-night in the hope of hearing many Officers who have considered the subject, and are much more qualified to address the meeting than I am. I hope to hear their opinions upon this, which is certainly one of the most important subjects that can invite the attention of military men. I am very anxious that those who take up this subject should really consider what we shall probably be exposed to in case of war. Now the paper we have listened to supposes that we are engaged in war with France, and that an enemy would be sent to our shores, who might, perhaps, effect a landing. Colonel Malet referred to the old English gentleman, who thought one ship would be able to carry back those who might survive such an undertaking. My belief is, in case we were engaged in war, we should be very suddenly exposed to invasion, not on one point, but on several. I should think nothing would be more easy than to collect three or four armies in France, each of which would be perfectly ready to attempt to make a descent upon this country, and I believe also they would not be at all terrified by the apprehension that one small ship would take the survivors back. As it would be easy to collect such Armies, it would be very unwise to look at this subject without considering the real danger that we may have to meet. I am quite sure that is what we all do desire to contemplate. I think the danger would be nothing less than that, that we should be exposed to attack, not from the ports of France alone, but also possibly from the ports of America and other countries, for we must contemplate the possibility, not of being engaged in war with one foreign power, but with several. The prize of this country is something so enormous, the booty to be obtained here is so much greater than that of all the rest of the world put together, that we must not suppose if we were engaged suddenly in war, it would be only one country that would endeavour to effect a landing on our shores, but my firm belief is, that very likely we should be attacked by two or three countries. We must always recollect the changes that have taken place within the last few years. Iron ships are now possessed by Prussia, by Denmark, as well as by France, America, and Russia. These powers are in the possession of iron ships that are perfectly able to cross the seas, and notwithstanding all the gallantry and skill of our sailors, who shall say that in dark weather, supposing there were several fleets endeavouring to reach the coast of England, one or two of those fleets might not be able to land two or three armies of, say, 20,000 or 30,000 men upon our shores? My belief is, notwithstanding the utmost gallantry and skill of our sailors, that is the sort of danger we ought to be prepared to meet. Now I cannot help doubting one proposal of the gallant Officer who wrote that paper, and that is, to divide our country by red lines in the way he has done, instead of localizing it more into our counties. I dare say he has had some very good reason for proposing that, but I have always thought that forces being connected with different counties, and also regiments connected with those counties, would the better assist each other, and would materially tend to the force and efficiency of the Army. I quite concur with him in the sentiment that the nation which called forth Volunteers is bound to instruct and arm them efficiently. There can be no truer sentiment than that, and it is one we ought to endeavour to impress upon our Government. Now I know that when an invasion was formerly apprehended, all these things were perfectly and efficiently attended to, because I have in my own possession all the proposals that were made in the early part of this century, and I know every line of hills which was to be defended, was fixed upon; that the county magistrates and all parties concerned were perfectly prepared; that every detail was settled where corps were to meet, where they were to be brigaded, where ammunition was to be sent to, and in short, every precaution was taken—I have it all in the handwriting of the Officers in charge of it—to resist invasion. I recollect at that time, some 40 or 50 years ago, an old man called upon the Adjutant-General one day at the Horse Guards. He came into the office and said, "Sir, I have got eighty waggons, each with eight horses, and carters to look after them, and I beg to place them at the disposal of the Government, to be sent at any moment to any place the Government may think right." He said "My name is Russell." He was the owner of "Russell's flying vans," and some of my contemporaries may recollect that on the Great Western road we used to see Russell's flying vans, with eight horses each, going to Exeter and to Plymouth, forty or fifty years ago. There is one subject to which, when considering the importance of our Reserve Forces as a means of defending our country, we ought not to shut our eyes, and that is the very great importance of having our railways upon one gauge. I do think with reference to the defence of our country, there is not anything more important than that. I recollect Sir Willoughby Gordon giving evidence upon that subject. He was asked what was the objection to the two gauges, and he stated that the inconvenience would be about the same as that of a ferry; that the inconvenience of moving from one gauge to another was as great as it would be to cross a river by a ferry. I think I heard a word about "short service" in the paper read to us. Now it is my firm belief, if the infantry of our Army were enlisted for a short service, instead of a long one, we should get a very superior class of men, and that among them we should find those who at the end of their service would be willing and desirous to be enlisted into our reserve, and so would form the most efficient reserve we possibly could have. That subject will shortly be brought before Parliament, and I sincerely trust it will receive the attention it merits. But I should very much like to hear the opinions of some military men here, whether an infantry soldier could not be rendered efficient in 4 or 5 years, considering that he probably would be a very superior man to what he is now, for I suspect that almost in every family in England you would find young fellows who would like very much indeed to enlist in the Army, if they could serve four or five years, instead of eight or ten, and if you had a more intelligent class of men, surely you would have time enough to make them good soldiers in so short a time as that. It has always appeared to me that a man could be made a good soldier in a period of that nature. Then I own there is another point I should like to see introduced into our "Reserve forces." I should like to see them brigaded for a much longer time than they are now. I cannot conceive that the short period for which our militia are called out can really make them efficient soldiers. It may be very well for a march past, or for a review, but to perform the duties of soldiers in the field, they ought to be out for a very much longer period, and that if they could be brigaded together long enough to receive some useful military instruction, it would be advantageous—I mean instruction with regard to field fortifications, and things of that sort. Also, with regard to the Staff College, it appears to me that that was a very desirable suggestion, that the Staff College should be open to them, because I believe there are some men who go into the militia who really have military genius and taste for those pursuits, and it is a great pity that they should not have the opportunity of studying just as well as officers of the regular Army.

Captain HOZIER, 3rd Drag. Gds.: Although I have not one-fourth the experience of the gentlemen who have already spoken, I trust I may claim the privilege which is accorded to every new member in every House, to say a few words upon this subject. There are many points in Colonel Malet's paper which must strike everybody. The redistribution of the country into new districts, the formation of divisions, the placing of head-quarters at important railway junctions, are all points which I think must attract universal attention. He speaks of our "Reserve forces," and in those forces he would include the Militia, the Volunteers, and, I presume, the enrolled Pensioners. Now, it appears to me none of these forces are "Reserve forces" in the real sense of the word. They are subsidiary forces, or auxiliary forces. They are forces which can be called out for garrison duty in the United Kingdom, but legally they cannot be called upon to recruit the ranks of the regular Army. They are not forces which can go anywhere and do anything as "Reserve forces" ought to do. They answer in the Prussian and French systems to the Landsturm and the Garde Nationale Mobile. Our "Reserve forces," as was stated in the House of Commons, are 2,000 men Army Reserve, and 3,000 men for Militia Reserve, so that we have 5,000 men to fill up the vacancies in 61 battalions of 560 men each. Now the war strength of these battalions is 1,200 men, so that in fact we should require a force of 50,000 men for the infantry alone, in order to bring them up to a war footing. Then we have no Reserve force for Artillery, no Reserve force for Cavalry, no Reserve force for Engineers; in fact we might almost practically say we have no "Reserve forces" at all. You may say the Yeomanry and the enrolled Pensioners would be excellent troops for the defence of the country, but then they are of no service if you have to go into offensive war, and it appears to me that if the country is deprived of the sword, the shield is of very little use to it. The danger of invasion is not so great as it was in the early part of this century, when the greatest military genius Europe had ever known, was attempting to carry out such an enterprize, but there is this danger to which we are exposed: I believe if a squadron of French or American vessels was able to chase our fleet off the seas, to lay off the Scilly Islands and intercept our commerce, there would be such a panic in England, the funds would fall in London, the dividends would be stopped, and the country would be driven into making peace before the enemy would have landed on our shores. If we want a "Reserve Force," we must have a Reserve force which will be able to defend London if possible at the barriers of Paris, supposing France to be our foe. But we have enemies equally dangerous with France, although France has always been looked upon as the natural invader of this country, and even if we were to repulse that invasion, what good would it be to us if we were not able to pursue the enemy? What good is a battle won if the pursuit is not carried on? And if we could not throw an Army into his country and threaten his capital, what use would our defence be to us? Unless we can do so we shall have no success in war; we shall no longer be feared, and shall have no voice in the affairs of Europe. In order to do this, we must have an efficient "Reserve force" which shall fill up the ranks of the regular Army, and enable us to send a powerful force to Berlin, to Paris, to Constantinople, or to Vienna, as may be necessary. To find such a "Reserve force" I believe is one of the most difficult problems that has ever been put before any military department. In foreign countries there is the conscription, and a man after entering the regular Army is naturally anxious to go into the Reserve. In this country a man goes voluntarily into the regular Army, and if he prefers that to all other professions, he remains in it. The question has been raised by General Peel as to the Militia Reserve. This is a subject on which I have no right to express any opinion, I can only trust that Parliament and the Secretary of State for War will find some way of forming a Reserve which will fill up the regular Army so as to enable us to have a powerful offensive weapon.

Colonel Malet: I and my friend who has just spoken, I think, are perfectly agreed. You recollect that at the commencement of the paper I said our Reserve forces are what we dignify by the name of "Reserve forces," though I do not consider them "Reserve forces" at all. I think there is a bad element which we may have to make the best of at a given moment, but I do not think it is at all the weapon which ought to be in the hands of England, or the sort of thing we require for the defence of this country, because I wish this country to be defended, as it has been hitherto, not at home, but abroad, and I hope that will always be the case. Above all, what I think we require is that the time of service should be shorter in duration than it is at present, first in a regiment of the line, and then in the Reserve. But until reason or misfortune shall convince the country that a great reform is necessary, my only object is, as far as I can, to indicate a method of dealing with our present Reserves, limited and bad as I fear they now are.

Major Gordon Ives: I think Colonel Malet began his paper by saying the conscription is the only way of recruiting the Army and forming a proper Reserve. In this I cannot altogether agree with him, although undoubtedly it would be the best. Failing that, he commences by trying to utilize the forces which at present exist, and the whole of his paper might be taken as pointing out a method of organizing the only kind of force which we can organize under the present system, short of a conscription or ballot. The first gentleman who commented on the paper preferred the ballot to the conscription. I humbly differ from him. The ballot is merely a means by which exemption from service may be purchased by money. The moment you are able to buy off your service in the Army, you make it a question of money, and the moment you make it a question of money, you set class against class. Now a conscription takes all classes. By a conscription you may have every young man in England. You may take so many, and you leave the rest, but at least you make no distinction of class, and you therefore can cause no discontent in one class over another class. The 1,200,000 men whom the French nation now support by the new French Bill is a conscription, and not a ballot, and by that conscription they take in all classes. No man is exempt from serving now in some form in the French Army, and, therefore, all classes being taken in, the whole nation is more or less content. A man who is born a labourer cannot say "I am torn from my family to serve my country because I am poor and unable to defend myself," because his near neighbour, who is wealthy, is in the same book as himself, and is obliged to serve in the Reserve Army. One gentleman, who has just spoken, has said that the only possible chance of defending England is to be able to send an invading army abroad. No doubt the best defence we could possibly have in England would be 200,000 men such as England now possesses in her regular Army, the finest troops in the world, and a Reserve of 400,000 men to back them of the same calibre—in fact, an Army of 600,000 men ready to take the field at any moment. But those are things the country cannot support. We are now tremendously taxed, and we have not to deal with what we should like to do, but with what we can do. If we could annihilate the whole British system of military service, if we could say, "We will have a system of 200,000 regular troops as they exist now, the finest troops on earth," if we could do that, regardless of all expense, and also have a Reserve of 400,000 men, drawn from the finest young men in England, ready to take their places, we could then immediately on a declaration of war send 100,000 men here, and 100,000 men there, and we could fight the world, as we have done before, and as I have no doubt we should have no great difficulty in doing again. But that would be a greater strain than we could possibly put upon this country; and what we have to consider is not what we would adopt if we could, but what we can adopt under existing circumstances, what the nation will stand, and what the common sense of the people is ready to adopt. What we have to consider is—we have got our country, and we have got to defend it. If it is assumed that it is impossible our country can ever be invaded, why should we trouble ourselves? But we begin our argument by assuming that it can be invaded, and not only can be invaded, but can be invaded by such a force as to endanger the very safety of the country itself; that our arsenals might be taken, and we might find the very heart of our empire, and London itself, taken before we could turn round, and so our very centre paralysed, our pulse stopped before we had time to organize the forces that exist. The paper is therefore directed to the object of organizing the forces that we have thought it necessary to have for the defence of the country. We have our standing Army, we have our Militia, we have our Volunteers, and our Yeomanry. All those forces either mean something or nothing. They are either useless, and an absolutely absurd expenditure, or they are an Army which in case of war might be called upon to defend the country. They are its very life, or they are nothing. A Volunteer is either a man who can be called upon to defend his home and his hearth, or he is an absurdity—he is something ridiculous. Then, what is a Militiaman? What is a Militiaman in the best sense in which you can take him? He is a man who may be called upon to be a soldier, to stand up for life or death for his country. I myself humbly suggest that he is a very inefficient soldier, because he cannot shoot, and, as at present organized, though they are often very well commanded, they are occasionally very badly commanded. However, that is not to the point. We have our Militia, our Volunteers, and our Yeomanry, and those men are the forces which at this moment the country supposes will be able to defend it from any invader. We begin by supposing that an invasion is possible, and an invasion of sufficient strength to take the country, and those are the forces which we have to organize, and Colonel Malet's paper begins by assuming that a conscription, if it were possible, is the best and the only means of really forming an Army with which every man might say, "I am satisfied." As I have already said, I do not agree with him. But a conscription on such a large scale as that, Colonel Malet supposes to be, for the present, impossible, and therefore he goes on to organize the forces as they at present exist. Whether those forces are efficient or inefficient, even in a state of perfect organization, is for the senior Officers of the country to judge, and for the Parliament of the country to judge on the advice of the military advisers of Parliament, whether those forces are sufficient when they are properly organized. But at the present moment everybody in the world knows that they are not properly organized—that they are not organized in the proper manner—that they are not organized at all—that they are simply disconnected masses all over the country without any organization whatever. Take the regular Army itself. War being declared, you would have recruits joining the Army, and supposing a battalion of the regular Army to be 500 men, within a month after the declaration of war that battalion would be raised to 800 men. Now, in the present day of shooting, it would be impossible to teach them to shoot, and when we know the tremendous strain there is in time of war on a single battalion without a proper Reserve, will anybody tell me how it is possible to get recruits who will be able to learn their duty? Because the duty of a soldier in the present day is not merely drilling, but shooting, for that is the essential part of warfare. Moving great masses of men, with decision and with rapidity, and enabling each individual man to shoot straight, are the two things we must never forget. Formerly a man might very soon learn to shoot with his battalion, but now individual shooting is a main element, and therefore I beg to say, simply as a Volunteer, that the Volunteers stand pre-eminent in their shooting, and that subject ought not to be forgotten in the question of the organization of the Army. At present, this force is armed with weapons known to be obsolete. In conclusion, I would simply suggest that in considering the pamphlet we have heard read, we ought not to forget that it does not suggest anything new, but is simply put forward as a means for organizing the force, which has been stated lately by our Secretary of State for War, Mr. Cardwell, to be perfectly satisfactory as a defence of the country, but which at the present moment is utterly disorganized, and Colonel Malet's paper suggests one means for organizing the forces as they at present exist.

Captain Colomb, R.M.A.: We are very apt, when we talk about the defence of the country, to forget the defence of the Empire. The country can be ruined in two ways; one is by assault, and the other is by investment. The gentleman who has just spoken has alluded to the danger of investment with regard to the Channel, and it is quite sufficient for us to remember that investment is a danger. I repeat what I have before stated, that we should, by an enemy placing a naval force superior to our own in the Channel, suffer with respect to our commerce at the rate of forty-four and a half millions of money per month. That is a thing which we must pay attention to, but it has nothing to do with the paper before us.

As I take it, the regular troops are for the defence of the Empire; that means for the defence of India, and for the defence of our Colonies, I should say, the indirect defence of our Colonies. Our regular troops are for that purpose, for the Navy is powerless without them. But having provided for that, we must also look to the defence of the citadel of the Empire—the British Islands; and whatever means are devised, or whatever schemes are put forth for rendering the soil of the British Islands secure, deserve the attention of every man interested in the defence of the country, therefore, I should like to make a very few remarks with reference to the paper before us.

First of all, the gentleman who spoke second put a very practical question for the consideration of those present—What we shall be expected to do in case of war?—I only speak with regard to the United Kingdom—and he very properly reminded us that we were liable to attack from several quarters, and of that there can be no question or manner of doubt, for this reason, that a number of small squadrons coming out of European ports are far more likely to elude the vigilance of our Channel fleet than a very large expedition. Therefore, in any scheme for the organization of our forces with the view of resisting invasion, we must bear in mind that not only have we to guard against a determined and violent attack upon some part of the coast, but we must also be prepared to guard against simultaneous assaults on detached points.

With regard to the paper before us, the first thing that struck me was with reference to the French occupation of Egypt. That is a question which is not directly concerned in the defence of the country: it is a question for the defence of the empire, and, therefore, comes very properly under the head of the organization of our regular forces. The colonies "screaming for reinforcements," which no doubt they would do, appears to me also to be more a question concerning our regular forces, because the mere invasion of England would not cause that circumstance to occur; it would be more the result of that other way of ruining the country by partial or complete investment, that is, cutting our lines of communication.

With reference to dividing the districts of England, there is a definite object in view, the power of moving organized masses of troops upon the assailable coast line. I am sure we all must agree that it is very good, for that is, after all, what our "Reserve forces" are for, if they are for anything; it is to assemble in properly organized masses regularly and quickly upon any part of the coast line that may be threatened. With regard to the details of that distribution, of course everybody has their own plan, and, therefore, I disagree with regard to the details; but with regard to the principle, I am sure everybody must agree who has really thought out the subject.

Now, there is one point in the paper which I wish to make a very few remarks about, "that regular troops cannot be localized." I may be permitted to say, as I belong to a "localized service" myself, that I disagree with Colonel Malet. I belong to a service which has its fixed head-quarters, whence its men are sent out to all parts of the globe in detachments numbering from 5 to 200 on short notice, perhaps in a few hours, with a complete organization. They return to their fixed head-quarters, their wives and families keep up their local connection with the place, and in every way, as far as my experience of fifteen years goes, it is an entirely satisfactory process. And I believe it is the true principle to be followed out with regard to Army reform, for this reason, that if you get a short service Army, which we are coming to, and must come to, the local connections of men must be preserved; as soon as a man gets his discharge from the Army he settles down again into civil life, he distributes himself, as it were, and, therefore, the more you can localize the Army, the more sure are you of a man being ready to take up his old place and his old post at the head-quarters of the district to which he belongs. Therefore, I believe "localization" possible, and indeed, Colonel Malet, I think, will remember that, to a certain extent the service to which he belongs is "localized." It has its battalions abroad, and it has its battalions at home, within a certain district, and, therefore, I must be allowed to express my idea that "localization" of troops is possible, and not only possible, but I believe it to be the true principle which will ultimately be followed out.

There is another point—and a very important one it is—with reference to the distribution of artillery and infantry, and I think Colonel Malet has pointed out what has always struck me as a very—I hardly know exactly how to express it—but as a very grave defect in the "Reserve forces," namely, that you have garrison artillery where you do not want them, and you have infantry where you do not want them. To make this evident, I will just go back to explain what I mean by referring to the question which one of the speakers asked, "What shall we be called upon to do in case of war?" Now, I am only speaking with regard to the defence of England. We should be called upon to hold certain fortified positions, Woolwich, Chatham, Dover, Portsmouth, Plymouth, Pembroke, and so on. Those are immense fortified arsenals, upon which the safety of our fleet depends, and not only that, but the safety of the country, for they may be the basis of operations for our Army. I note the constitution of the "Reserve forces" surrounding these fortified points, and what do I find? I find a small proportion of garrison artillery, and a very large proportion of infantry; in other parts of England, where there are no fortifications at all, I find garrison artillery, and so on. Therefore, that point in the paper is, to my mind, a very important one, and I believe that, with reference to the fixed and fortified points, the true policy is to convert the whole of the surrounding districts into garrison artillery, with their head-quarters at the fortified point.

With regard to field artillery, my own impression is, as an artilleryman, that there is no hope of ever having an efficient field artillery of the "Reserve forces," and, therefore, I believe that the true policy of the country is to keep up her field artillery to a strength not merely in proportion to the line of our regular troops, but equal to the line of those regular troops and their reserves, whatever they may be.

With regard to re-numbering and telling off Volunteers by brigades and districts, I know by experience, from having been employed on one or two Volunteer reviews, particularly with regard to the garrison brigades of Volunteer artillery, that there is nothing more prejudicial to system, and there is nothing more likely to give rise to confusion than the defect pointed out in that paper, and that is not having them numbered according to their position in the brigade and division to which they belong.

And having made these remarks I wish to say, I think with reference to the distribution of troops in the United Kingdom, that we are all bound to come back in point of fact to the original question, what will we have to do with our "Reserve forces" as they are, not as they may be, because we may have war before we have time to organize anything else. But, whatever forces we have, we must bear this in mind—we do not know when we may have war, and we must know that these forces are for war and nothing else, and therefore any scheme that can bring before us a practical plan by which the exigencies of war can be met by our war forces deserves consideration, and I am sure a great number of points in the paper which has been read this evening, and which I have mentioned, deserve very serious consideration.

Lieutenant-Colonel LEAHY, R.E.: Much that I had to say upon this subject has been anticipated by Captain Hozier, who has pointed out what our "Reserve forces" should be. I only wish to add that I believe the great defect of our military system has been the system of re-engagement and long service. It was not the original intention and constitution of the British Army that the service of the soldier should be long—in fact we all know that soldiers were only originally enlisted for a campaign. It was only at the beginning of the last century that the field artillery was organized on a permanent footing, and this is the force that requires the longest training, and, as has been most justly observed to-night, the force that ought to be kept up permanently on the largest scale. I believe the true remedy for insufficiency of "Reserves" is that pointed out by Lord Grey before the Recruiting Commission, and I cannot understand why that Commission did not notice the important evidence that he gave before it. He suggested enlistment for a short period of service, with liability to serve afterwards in a "Reserve force." That is the true principle of a "Reserve force" for supplying the men required to fill up the ranks of the regular Army. This principle also ought to be applied to our Militia—a large proportion of our Militia are now re-engaged men, which is a great mistake. Our great object ought to be to have as many men in the country as possible who have had a military training. I fully concur in what one gentleman stated, that rifle shooting is such an important part of our military instruction that the Volunteers, or any organization which will encourage instruction in shooting as a part of the civilian's education, will tend to increase our military strength. Much has been said in the abuse of Mr. Cole and his "Parliament," but I think there is much force in what he says, namely, "that he would wish to see as large a proportion of the people as possible receive some military training, and he would begin it at school." We know that there are Volunteer corps at some of our public schools which have attained considerable efficiency, and I do not see why the system should not be extended throughout the whole country. If it were so, our military force would probably require a shorter period of training, and taking economy into question, the shorter the time they are under instruction, the better.

I do not believe this country will ever listen to the word "conscription;" we must depend upon a Volunteer Army, however it be raised. Considered economically, the question is this—We have four classes of forces. *First*, the Volunteer, who costs the country a very small sum per annum, not more than a Swiss soldier, about from £1 10*s*. to £1 14*s*. a year. The larger number of these we have the better, their moral influence is very great. Then come the Militiamen, who cost perhaps *four* times as much as the Volunteers—in my mind too much, in consequence of the expensive staff that is kept up for their instruction. I do not at all see why having, as we have, a large proportion of Officers in the regular Army, a certain number of them should not be lent for teaching the Militia. The Militia Staff, consisting of about 5,000 men, costs more than the Militia who are trained—some 70,000 or 80,000. I should like to see less spent on the permanent staff and more on the training. The next force we have is the "Army Reserve" soldier, who costs more than the Militiaman does, and it is a class that ought to be in every way encouraged. Then you come to the regular soldier, who costs about four or five times what the "Army Reserve" soldier costs, and from 20 to 25 times what the Volunteer costs. They ought to be as few and as perfect as possible, looking for support to the men in the "Reserve" force.

The matter may further be looked at from this light. We now enlist from 15,000 to 20,000 recruits a year. If a shorter period of service was instituted, and service for the colonies and India was made a separate engagement, we should only require from 7,000 to 8,000 to keep up the Colonial and Indian Army. Upon examination of the statistics before the Recruiting Commission, it appears to me there are about 12,000 "loafers" in the country who are always glad to enlist as soldiers, and make the Army their profession. Now we have to go beyond that number, and give bounty to induce some 3,000 or 4,000 men in addition to join. If we had separate engagements for colonial service in place of having to give a premium to add to the number of men who are naturally willing to join the Army, we ought to send away some 4,000 or 5,000 of them, and those men would be only too glad to serve in a "Reserve force." I therefore think that short service is the remedy for insufficient Reserves, and I have not the slightest doubt but that it could be carried out without any great disturbance of existing arrangements.

With regard to fixing the districts of the country with reference to railway communication, that is a subject brought before a meeting of this Institution last year. I then recommended a plan, giving the details, on the principle that our military districts ought to be based with reference to our railway communications. In a matter of detail I think Colonel Malet has made one mistake. In his Western District he includes places to which the broad gauge does not extend. I made it a little different, in order to keep the broad gauge lines in one district and the narrow gauge in another, but the principle is right.

Colonel **MALET**: Lieutenant-Colonel Leahy is probably not aware that the Great Western Railway are now adopting the narrow gauge.

The **CHAIRMAN**: The two gentlemen who last addressed the meeting are well entitled to be heard before it, for both these gallant Officers read most useful papers, remarkable for their ability, in this Institution, Captain Colomb this year, and Lieutenant-Colonel Leahy last year. The one is already published in our Journal, the other will shortly be published, and I do not hesitate to say both of them are valuable contributions to the literature of this Society, as well as a general benefit to the country. My hon. and gallant friend, Colonel Malet, may at least be assured of this—that he has produced a paper here to-night which is able in itself and has the merit of having given rise to a most interesting discussion. He has raised the point, though perhaps not going into the whole question, of what should be the defensive resources of the country, both with regard to its internal as well as its external defence, and there are points in it, which this meeting has already recognized by the speeches we have heard, as well worth the consideration of the country.

Captain Hosier, I think, hit the nail on the head first when he pointed out the difference that existed between the "Reserve forces" for the defence of the country, and the "Reserve forces" as a supplement to the Army. There are, no doubt, two kinds of "Reserve forces." We have first the Militia "Army Reserve," as they have been called, and secondly the Volunteers. But we most undoubtedly have no "Reserve force" at the present moment by which we can supplement the line in the case of taking the field. It is now settled that every regiment at home is to be of the strength of 560 men. If war was declared those regiments would have to be filled up to at least 900 or 1,000 men, and where are we to get the men to fill them up? That is the question which this country has now to solve; that is the question which the Secretary of State for War is now engaged, and his predecessor was engaged in considering. It is a most difficult question. It is very easy to prepare a paper about the advantage of short service, but when you come to consider the question of how you are to get these 30,000, 40,000, or 50,000 men, to have two "Reserves," namely one "Reserve" to put into the regiments to make them up 900 or 1,000 strong, and another "Reserve" to supply those vacancies which must immediately fall upon regiments after they have taken the field, not only by casualty in action, but by what is much worse than the mortality that occurs in action, namely, sickness in the field; you therefore require not only 30,000 men to put in the Army, but you must have another 30,000 men ready to take their place when the regiments that go out first, fall short of their numbers. With regard to the "Reserve Forces" for the defence of the country, it is perfectly true that there is no organization. These forces have been raised at different times; they rest upon different Acts of Parliament, and at the present moment there is no machinery existing by which these forces can be brought together. The Militia at the present moment cannot be put under the command of General Officers of the districts. The Volunteers you have no power over. They go out when they please, and no authority either from myself as the Chief of the "Reserve Forces," or from the General Officer of the district, can bring them out. Now it will be a grave question by-and-bye whether there should not be terms made with them by which upon certain occasions they shall be bound to assemble and place themselves in the hands of the Commanding General Officers of districts. However, at the present moment it is the case that those forces have no cohesion, and the law as it at present stands, will not allow of their being brought together. As to what may be the eventual mode of doing it, I do not know, but I hope in course of time we may find means to so far organize these forces that they may be not only available in time of war, for then they are certainly much more available, because an Order in Council can place them at once under the Mutiny Act, but that we may make preparations for war in a time of peace, by having the power to assemble and to instruct these troops.

Some remarks were made with regard to the Militia. It so happened that, last year, I inspected a great number of regiments of Militia, and I can only say this, I found them in most admirable order. It is perfectly true they did not go far enough. I inspected some regiments that, as far as machinery and drill went, astonished me; but I said to them, "I am very much pleased at what I have seen, but I have not seen as much as I should like. You cannot do this, you cannot do that, and, therefore, I do not consider you have done as much as you ought to do." I trust we shall make a little advance this year. Amongst other things, rifle practice has been alluded to, and there is no reason why the Militia should not go through a course of rifle practice. It has been unfortunately left in previous years to Commanding Officers to do as they pleased with regard to it. This year we shall get some Sniders into the hands of the Militia, and in another year I hope they will all be armed with that weapon. I fondly expected this year that the whole force of Militia would have been armed with them, and that we should have been able to carry out a regular system of rifle practice with Sniders in their hands. However, that cannot be; but it is essential that Militiamen should be taught to fire, and taught under a regular system, a system as complete in its operation as that of the regular Army; that they should be well looked after, and the results of their practice published in the same way as the records of target practice are published now. I believe we shall be able to accomplish that, and I fully believe that, efficient as that force is as far as it goes, and it is wonderful that they are so efficient, we shall make them still more so than we have already found them.

Now, with regard to the Army service. We must come to this, that if you have a short service, you must say that you will not allow a man to re-engage. It is a difficult thing to say that; it is a difficult thing to say to a man who likes the Army that you won't allow him to go on; and we have not, I believe, ever got to establish such a principle as that: but the fact is, at the present moment—it may astonish some people out of doors—I do not hesitate to declare that the Army is essentially a popular service in the country. There is not only no difficulty whatever in getting men, but they re-engage by wholesale. For instance, men are allowed to re-engage after they have served six years and a half now, and hereafter it will be eight years when we get the twelve years enlistment into operation. The men do not take their discharge, but they re-engage; they re-engage three or four years beforehand for a term of nine years afterwards. The pension, no doubt, is a considerable object. The consequence of that is, that if we had a short service, and allowed re-engagement, the men would not go to the "Reserve," they would stay with their own regiments. Those that like the army would stay with their own regiments, and those who were tired of the Army will not go into the "Reserve." We offer good terms at the present moment. We offer men who have taken their discharge at the end of ten years, and men now serving who are in excess of the English establishment, who have completed six years and a half, to take them for a further three years and a half, and join the first "Army Reserve." Those who have taken their discharge we invite to enter the "Army Reserve," where they will get £4 a year, and only have to come out for twelve days. But they won't take it. Things may alter they say. The soldier, we all know, is a shrewd and a remarkably suspicious man; he is never quite sure what is to be the operation of the next change; and there may be something in that. Possibly, in a year or two they may see the advantage—or their wives may for them—of having £4 a year upon the bare chance of being called upon to take the field in the event of there being a war; and as we know this country will not very easily engage in war, and must be driven into war before it will embark therein, it is evident that the men are almost perfectly safe to get £4 a year for doing very little.

Then, with regard to districts, I cannot exactly express any opinion upon the actual *corps d'armée* districts which I see before me, but there is no doubt whatever the districts of this country will have to be altered. If you take the Northern District you find that it is a gigantic one. I am afraid to say exactly what is the number of troops altogether in the Northern District, but I rather think it is upwards of 100,000, including all branches. It is evidently far beyond the power of any one man to fulfil the duties of that situation if the "Reserve forces" of a district are all to be placed under the command of one General Officer, as ought to be the case. Then, in the Midland counties there are no regular troops, but there are vast numbers of Volunteers; and, as the gallant Officer said just now, there are riflemen where they are not wanted, and artillerymen should be, where they are not. Unfortunately, when that force was first formed, they were allowed to select what they would like to be; nobody seemed at all to regulate how the force was to be distributed, or what their particular duties were; and although, looking at the whole force, the larger quantity of artillery are to be found in maritime counties, yet, at the same time, artillery is to be found where artillery would never be wanted: at any rate, if they were, they would have to be removed from the counties in which they are now situated.

"Field Artillery Reserve forces" were mentioned. I do not hesitate to express my opinion against "Field Artillery Reserves," and for this reason. We all know in the Royal Artillery that it takes three years to make a good driver. I do not mean to say by that it would take three years to make an ordinary driver—probably you may do it in much less time; but still a good driver is essential for field artillery. The gunner can be taught field artillery drill, to a certain extent, without taking the battery into the field; but the Officer who commands the battery, the non-commissioned officers who are attached to the battery, the driver and the horses—no small element—but, however, the driver in particular cannot be properly trained in the Volunteer or Militia services. Let the guns be prepared; let Woolwich be full of guns; let all the gunners, whether in the Artillery, the Volunteers, or the Militia, be taught field artillery as far as the drill part is concerned; and then we may attach them to the Royal Artillery, and they will be found in a very short time capable of doing the work of gunners in the field; but the drivers are a great branch of the profession who must be taught; and if you are suddenly obliged to take the field, you cannot find drivers as fast as you want them.

The Staff was alluded to, and that is an important point in the organization of our "Reserve forces." I do not go so far as to say "open the Staff College," because I think the class of Officers who belong to the Militia and the Volunteers would not be able to go through what is usually termed the "Staff College course;" but what I should like to see is this: I should like to see a Staff School established at the Staff College; I should like to see regimental schools established in regiments of the line in different parts of the country, not absolutely to force the Volunteer Officers to attend them, because it is hardly possible to expect them to leave their occupations entirely, but at any rate, you should give the opportunity to the Volunteer Officers and Militia Officers to attend these classes, in order to qualify themselves for their position in the Reserve forces. I would do the same thing with the Officers commanding regiments, particularly the Volunteers, because many Officers command regiments in the Volunteers who have no other qualification whatever than their social position. I would even go so far as to say this: I should like to see future Commanding Officers obliged to go to the Staff School in order to obtain to position of command. I would establish such schools at Aldershot and Sandhurst, where they might learn to manage battalions and brigades. If we do organize the force in brigades, which is perfectly possible, not perhaps at the present moment, but by-and-bye, it is essential that they should know how to command, and I cannot see how a man is to command a brigade in the field, who has never commanded a battalion. As a general rule, you will find the troops are massed in the south of England; those are the important points as far as the historical feelings of the country with regard to invasion are concerned. The force is small, but railways give us the power of concentrating our troops wherever they may be wanted.

Having said thus much, I need only say further, that I am sure you will all agree with me in passing a vote of thanks to Colonel Malet for having written this paper, and to Sir Alexander Malet for reading it; and I think that this discussion will be most beneficial to the object Colonel Malet had in view, when he wrote that paper.

Evening Meeting.

Monday, April 5th, 1869.

Admiral Sir Henry J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 22nd March and the 5th April, 1869.

LIFE.

Watts, J. S., Navigating-Lieut. R.N. 9*l.*
Mills, Richard, Capt. Civil Service Rifle Vols. 6*l.*

ANNUAL.

Jenner, Stephen W., Lieut. Roy. Engrs. 1*l.*
Lawrence-Archer, J. H., Capt. (h.-p.) 4th W. I. Regt.
Hext, Henry W., Captain Roy. Engrs. 1*l.*
Sexton, M. S., Captain Roy. Art. 1*l.*
Grant, W. B., Captain R.N. 1*l.*
Russell, C. R. T., Lieutenant R.N. 1*l.*
Gimson, Herbert, Navigating-Lieut. R.N. 1*l.*
Currie, James P., Major Civil Service Rifle Vols. 1*l.*
Jerome, John, Major 86th Regt.
Walker, W. L., Lieut.-Colonel (ret.) Indian Army. 1*l.*
Hime, F., Captain Roy. Engrs. 1*l.*
Allen, George W., Lieut. R.N. 1*l.*
Kemp, F. R. B., Lieut. R.N. 1*l.*
Graham, Donald D., Captain, late Ceylon Rifles. 1*l.*
Morris, Mark, Esq., Naval Instructor. 1*l.*

THE CONVERSION OF OUR SCREW LINE-OF-BATTLE SHIPS INTO ARMOURED TURRET SHIPS.

By Charles F. Henwood, Esq., Naval Architect.

It will, I think, be generally admitted that our unarmoured screw line-of-battle ships, are for actual warfare valueless; but is it certain that they cannot undergo such modifications as will, at a moderate cost render them extremely valuable? My object this evening is, to prove to you that many of them can, and that great economy would thereby result in our naval expenditure.

The Secretary to the Admiralty, in March, 1867, stated in Parliament, that there were 55 ships of the line, the value of which including those in commission was about £8,250,000; and the annual cost of merely keeping them in a proper state of repair, £117,260.

The question, therefore, also involves the utilization or sacrifice of this large amount of valuable public property.

It may not be out of place briefly to glance at what has been already done, in the way of converting screw-ships of the line into iron-clads.

In the year 1860, there were about 12 screw-ships of the line laid down of the "Duncan" class—

LINE-of-Battle Ships of the "Duncan" class already converted into iron-clads on the broadside and box principle.

Name.	Length.	Tonnage.	H.P.	When converted.
	Ft.			
Ocean	273	4047	1000	1863
Caledonia	273	4125	1000	1862
Prince Consort	273	4045	1000	1862
Royal Oak	273	4056	800	1862
Royal Alfred	273	4068	800	1864
Zealous	252	3716	800	1864
Repulse	252	3749	800	1868

Total first cost of the above seven ships, £1,688,408.

Of these the "Ocean," "Caledonia," "Royal Oak," and "Prince Consort" (See Diagram No. 3) were converted into iron-clads, wholly protected, on the broadside principle—the "Royal Alfred," "Zealous," and "Repulse" into iron-clads, partially protected on the "box-principle." The only screw-ship of the line converted as yet into a turret ship, is the "Royal Sovereign," which is universally considered a very formidable vessel of war. Satisfactory opinions have also been expressed with regard to the fighting powers of the converted screw ships of the line on the broadside principle. Admiral Yelverton reports, November, 1866, of the "Ocean" and "Caledonia," as follows:—

"As serviceable and cheap iron-clads for line-of-battle, and hard "fighting in a moderate sea, my experience leads me to the conclusion, "that they are most efficient ships of war. In steaming full-speed, "the 'Bellerophon,' 'Caledonia,' and 'Ocean' were nearly alike.

"I do not hesitate for a moment in recommending, that the number "of this class of vessel be *doubled*, by the conversion of some more "of the now useless line-of-battle ships into vessels of this description."

The following extract from an account of the voyage of the "Ocean" from the Mediterranean to China (taken from the "United Service Gazette" of September and December, 1867), fully confirms the good opinion formed of her by Admiral Yelverton; and as it will reply to many objections which have been urged against this conversion scheme, it will not, I hope, be considered out of place, nor prove uninteresting:—

"The 'Ocean' left Gibraltar on the 17th June, 1867, arriving at "Madeira on the 25th, under easy steam and canvas, winds being very "light—left for St. Vincent on the 28th, doing the entire distance from "Madeira to St. Vincent in seven days under canvas alone, winds very "variable and light—the next day she left for Rio de Janeiro, where "she arrived on the 29th July (under easy steam and canvas, she "averaged 12 knots), beating the 'Dryad' (one of the Amazon class), "which left Madeira 4 hours before the 'Ocean,' by an hour—left "Rio de Janeiro for Singapore on the 10th August, and up to the

"24th encountered nothing but light winds and calms; on the 24th it "commenced to blow fiercely from the north-west, it soon freshened "into a gale, and the sea rose in a manner that would have startled "the Channel Fleet; from the direction and intensity of the wind, it "was supposed to be a pampero from the River Plate, it lasted "48 hours, during which time she ran 445 knots, without getting "the deck wet, under reefed topsails and courses, being as steady and "stiff as a rock, and at the same time as buoyant as a cork,—50 miles "being run in 4 hours in a ship all but jury-rigged,—sailing best when "able to carry all plain sail, to a stiff breeze, when she averages "8 to 9 knots an hour. On 2nd September just rounding the Cape, "it commenced to blow from the south-west, with a high, 'rough and "tumble' sea, the wind lasting 9 hours.

"September 2nd to 8th almost a calm. On the 8th it set in squally "and black, with every prospect of bad weather—things were made "snug just in time for a gale from the south-west, accompanied by a "sea whose waves were estimated from 40 to 60 feet high. The gale "lasted for two days, the ship running as before, and scoring 360 knots "on her way—all hands much pleased at her performance, and almost "wishing it to blow a gale every day, as not being able to set sail "enough, they wanted something like a gale to send them on to "Singapore.

"On the 11th it blew as hard as ever, this tried her to the utmost; "but she behaved admirably, and far better than was ever thought a "ship of her description could in a heavy sea; this lasted for 3 days, "and the 15th was a dead calm; the next day it appeared as if a "cyclone was approaching, and blew so hard, that steam was got up; "the sails having been tried so severely previously; in a few hours it "burst on the ship with a fury that was awful. It was decided "on running at full speed under steam, being impossible to lay to, as "not a rag of canvas could be shown. This was no sooner carried "into effect, than away went the 'Ocean' at a speed never before "attained by any iron-clad of any nation. The sea was blown in tons "over the deck, washing all before it.

"This storm was a trying one for the ship, starting 5 huge beams "out of their scarvings in the engine-room; but not a single armour-"plate started,—a few rivets soon mended the beams, nothing else "being started in the ship.

"The 'Ocean' on this occasion went faster than she had ever done "before, and it is hoped she ever will again; the speed could not have "been far short (in the fiercest gusts) of 16 knots.

"On the 21st the sea moderated, and being able to spread 'all plain "'sail' without fear of the spars being carried away, she ran well, "averaging from 8 to 9 knots, showing what she might do, if pro-"perly rigged, as she ought to be.

"She arrived at Singapore on the 23rd September, having en-"countered such a succession of gales and stormy weather as none of "Her Majesty's ships of late years have had the ill-luck to meet with "on the China passage, and which establishes her character as a "thorough sea boat, and a good 'Ocean Cruizer.'" And in the last report of the Channel Fleet (1868), page 5, Admiral Warden says, of the "Prince Consort" and "Royal Oak:" "They have good qualities, "they are armoured throughout—are powerful ships, *handy under* "*steam*, from being short, with good speed, and do sufficiently well "under sail."

But the Controller of the Navy remarking on Admiral Yelverton's recommendation, says, "I am of opinion that all converted ships of the "'Caledonia's' class, are inevitably heavy rollers, from the position "of their weights, and I consider *the defect* a sufficient reason for not "adopting Admiral Yelverton's recommendation for doubling the number "of ships of this kind." Also Captain Armitage of the "Prince Consort," in last report of Channel Fleet, considers *the defect* of heavy rolling, too serious to pass over lightly, although "in other respects she is a "serviceable ship, remarkably handy under steam, and stays well."

The Controller of the Navy also objects to conversion after the "'Zealous,' or partially armoured class, leaving wooden unarmoured "extremities fearfully liable to be set on fire by shells, a catastrophe which happened to the Italian ship 'Palestro' at the battle "of Lissa.

"Except, therefore, as a makeshift, and only *if nothing better* can "be got, I could not recommend Admiral Yelverton's proposal for "adoption."

Now, these objections are entirely obviated by my plan of conversion.

It will be seen that the weights of the "Caledonia" are very differently disposed to what they would be in the "Duncan" converted (see Diagram, No. 3); the effect on the rolling of the two ships may be illustrated, as follows:—

Take the two sides of the "Caledonia" between A and B at weight of about 700 tons, and in an otherwise similar ship put the 700 tons in the shape of turrets in the centre at C. The distance of the 700 tons, A, B, from the axis of rotation, G, being 28 feet, that of the 700 tons at C being 12 feet, the result therefore in each case would be—

	Tons.	Moment of inertia.
Broadside "Caledonia"........	700	$\times 28^{(2} = 548{,}800$
Turret "	700	$\times 12^{(2} = 100{,}800$

thus, in this particular, the broadside "Caledonia" would have more than five times greater tendency to roll than the turret "Caledonia."

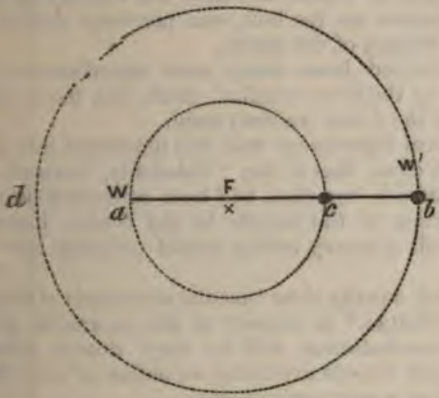
The application of this important dynamical law to naval architecture, viz., "that the effects produced by weights in motion are in proportion to the square of the velocity," was first propounded by my father in 1830. And as it has an important bearing also in relation to many of the iron-clads now building (I refer to the *heavy*, lofty armour-plated sponson-batteries on the upper decks of the "Invincible" class, and "Sultan"), a simple demonstration of it may not be uninteresting, and I cannot do better than take it from a lecture by Captain Fishbourne, C.B., R.N.

"While remaining at rest, a greater weight at a less distance, will balance a less weight at a greater distance, but when set in motion the balance no longer obtains, for the weights under this latter circumstance act according to the squares of their respective distances from the axis.

Let W balance W′ on the lever, a b, F being the fulcrum or centre of rotation. The moment $W \times F a = W' \times F b$.

Suppose the lever to make one complete revolution, then velocity of W : velocity W′ : : circle, a c : circle, b d : : F a to F b; the moment $(W \times F a) \times$ velocity of W = effect of W in motion: and the moment $(W \times F b) \times$ velocity, W′ = effect of W′ in motion, or momentum of $W = W \times F a^2$,—and momentum of $W' = W' \times F b^2$. Hence it appears that the effect of any rotary weight is as its moment × its velocity.

Suppose W placed at c, and



Let W = 14 lbs., F c = 2 ft.   W′ = 7 lbs., F b = 4 ft.
Moment W = 14 × 2 = 28 = Moment W′ = 7 × 4 = 28 „
„ of inertia W = 14 × 2 × 2 = 56 ft.
„ „ W′ = 7 × 4 × 4 = 112 „

This law was further proved by experiments made by my father—*the first* being suggested by Professor Main.

Two bars, one 6 feet long, the other 3 feet, were placed on the same axis with weights at their extreme ends, so that either arm of one bar would balance either arm of the other, were they cut in two and joined. The bars were tied together with a single twine, with a bit of hemp moistened with spirits of turpentine between its threads, which was set fire to at the instant of making the bars revolve on the axis. The bars revolved together till the twine was burnt, and from that instant the number of revolutions of each bar was counted; a mean taken of several trials, showed the number of revolutions of the long bar to be to those of the short bar as 3·5 to 1.

Making due allowance for friction, and resistance of the air, and the accelerated motion of the short bar through its being tied to the other, it is to be concluded that the same moving force produces four times great effect, or extent of motion in the long bar, as in the short bar.

The second experiment was made with two mauls fitted so as to str on bolts. Holes were bored with the utmost precision in a block wood of uniform solidity, and copper bolts cut from the same were driven 2 inches each into the block for the experiment. The t mauls used were 13 lbs. each, one fitted to descend by gravity i circular arc of 3 feet radius, and the other a 6 feet radius. It is v known that a heavy body let fall from a height of 1 foot, acquire velocity of 8 feet per second; if it descend 4 feet, it acquires a velo of 16 feet. The object in the experiment was, to make the maul w the 6 feet radius strike the bolt with precisely *twice as great* veloc as the maul with the 3 feet radius; accordingly it was necessary allow the 6 feet maul to descend from a height of 4 feet, and the 3 f maul from a height of 1 foot, and then the velocity of the former, the instant of impact on the bolt, was precisely double the veloci at the instant of impact of the latter.

The result obtained from many such experiments was, that t effect produced by the 6 feet (radius) maul, was more than *four ti* that produced by the 3 feet (radius) maul.

Thus by practical experiment was this important law *proved.*

It is therefore clear, that if the "Caledonia," instead of being c verted into a broadside iron-clad, had been converted into a turret sh with a large portion of the weight in the centre, instead of at broadside, the fault of heavy rolling would certainly have been grea diminished.

It is also, I think equally clear that the six vessels of the "Invincibl class, and the "Sultan," in respect to the enormous weight of th upper-deck-sponson-batteries, will be very heavy rollers—and t defect in seven new vessels involving an outlay of over £2,000,000 only be regarded as a very serious error.

The second objection against conversion after the fashion of "Zealous" on the "Box"-plan, leaving about two-thirds of her len above the main deck unprotected, and liable to be set on fire by she as well as the main deck afore and abaft the "Box," is also obvia in the proposed plan of conversion; yet, notwithstanding the obj tionable feature of the "Zealous," the "Repulse" has lately b converted as "Zealous," at a cost of about £256,000.

Plan of Conversion.

Cutting Down.—The plans and model[*] have been prepared from actual working drawings of Her Majesty's Ship "Duncan," supp to me by direction of the late Board of Admiralty. No. 1 represe the hull of the "Duncan" as a 90-gun ship, from the water-line That portion which it is proposed to remove, consists of the po upper, and main-decks, together with the heavy ship's sides and th fittings, as shown also on the section plan, No. 3; this completes

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[*] The model can be seen in the Museum of the Royal United Service Instituti

Diagram No. 1

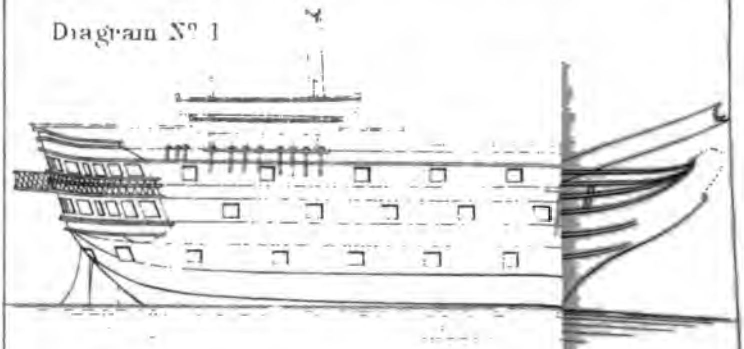

Diagram No. 2

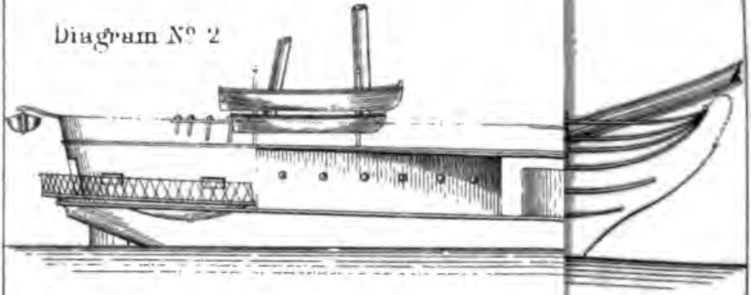

Diagram No. 4.

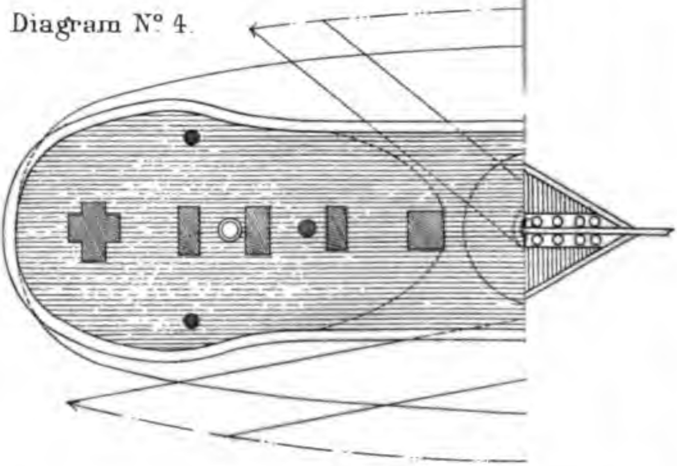

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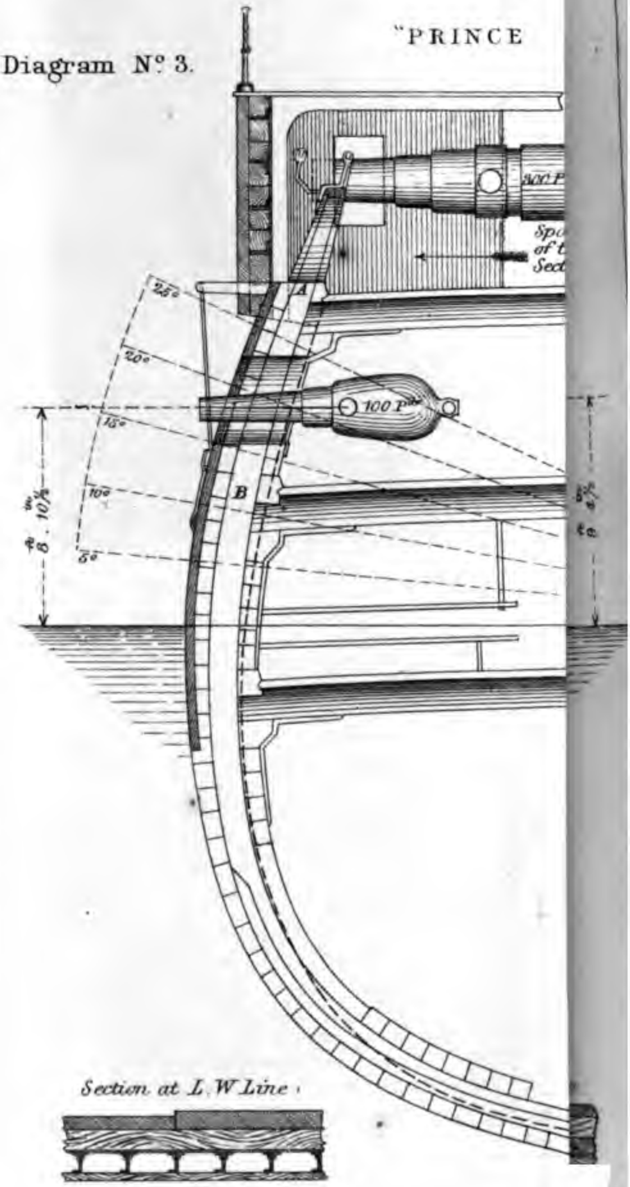
Diagram No. 3.



Section at L. W Line

of "Invincible" Class.

Job

cutting-down process, and leaves but little of the topsides above the gun-deck, those small portions are necessary however to the proposed plan of conversion; the remaining portion of the hull of the ship, which contains the machinery, boilers, coal-bunkers, magazines, store-rooms, and a complete lower-deck for the accommodation of the officers and crew, it is proposed to utilize in the following manner:—

I first cover the deck with 2 thicknesses of $\frac{3}{4}$-plate, except under poop and forecastle, which is of one thickness, and the sides in way of the armour, with plates $1\frac{1}{2}$ inches thick, the upper plates on the sides being connected to the deck-plating by a strong angle-iron extending all round the ship; the teak backing, and doubling is then brought on, and securely bolted to the hull, a teak deck is also laid over the iron plating on the Monitor deck. It will readily be seen what an enormous increase of strength is thus added to the hull, making it of much greater strength than the "Ocean" class, which have no additional strength given by their plan of conversion. The armour-plates, it is proposed to secure to the teak backing on the French system, and to sheath the armour-plates with teak plank in the usual manner, so as to be coppered, or else sheathed with zinc without the intervention of the teak covering planks.

This completes what may be termed the Monitor, with the exception of the turrets—add the turrets, and we have the complete fighting ship. The forecastle, poop, and spar-deck have now to be added to make her a sea-going Monitor, and to enable her sails and anchors to be worked, without interfering with the firing of the guns from the turrets, and for stowage of boats, &c. (See Diagram No. 2.)

Thus, I submit is fulfilled the requirement of the Board of Admiralty, as stated by their Secretary in July last, viz.:—"They did not want "a turret ship of the 'Miantonomoh' class, but a vessel which would "go to sea, keep at sea, and be able to remain there for weeks."

The spar-deck, fore-part of poop, and the after-part of the forecastle are constructed of iron.

The turrets are plated with armour 6 inches thick—those of the "Royal Sovereign" being plated with armour $5\frac{1}{2}$ inches thick.

It has been said that such converted line-of-battle ships would have weak and exposed stern-posts and rudders, and would be incapable of being used as rams; this, however, is but a theoretical idea, which experience of facts dispels, for Admiral Sir Sidney Dacres, speaking of the "Prince Consort," one of the converted line-of-battle ships, says: "Her rudder is well hidden;" while, on the other hand, Admiral Yelverton says of the "Bellerophon's" rudder, which was designed to be "well hidden," that "the captain of the gun who would fail at moderate range to hit it, when she pitches, must be a bad shot."

As to *ramming*, the battle of Lissa showed clearly that wooden converted ships could be used very effectively, and securely as rams; and with reference to this matter of "ramming," the following extracts from Channel Fleet Report, 1868, are, I think, of interest.

Admiral Warden says (page 7), "The subject is one which exists "principally in the region of speculation.

"The form of bow, which I believe best calculated to deal the "hardest blow, and carry with it the greatest amount of destruction, "is the straight upright stem of the 'Achilles,' or the slightly curved "one of the 'Minotaur,' rather than the projecting prow of the 'Bellerophon,' and others of a similar form. The result of the experience "gained when the 'Amazon' *rammed* a steamer in the Channel is not "encouraging."

Captain Armitage (page 42) says, "For general handiness for insuring "speedy evolutions, and for promptness of execution in giving effect "to ramming, the 'Bellerophon,' 'Royal Oak,' and 'Prince Consort' "possess considerable advantages over the class of longer vessels, "represented by the 'Minotaur' and 'Achilles.'"

And Captain Boys (page 37) says, "I am of opinion that the "'Minotaur,' 'Achilles,' and 'Warrior' can turn quick enough for all "evolutions under steam, and their manœuvring qualities would be "improved if they possessed rudder power corresponding to the 'Bellerophon.'"

With regard to this question of quick-turning, or handiness, it appears not to be generally understood, that the "Bellerophon" has a balanced rudder, in ratio of 1 square foot to every 26 square feet of longitudinal section or area; the "Achilles" on the other hand has an ordinary rudder, with but 1 square foot of rudder to every 60 feet of longitudinal section or area; thus "Bellerophon" has 130 per cent. greater rudder surface than "Achilles." Moreover the "Bellerophon's" rudder, commands an angle of 38°; that of "Achilles" only 25°.

	"Achilles."	"Bellerophon."
Longitudinal area......	10,038 sq. ft.	6,540 sq. ft.
Area of rudder........	166 sq. ft.	252 sq. ft.
Angle of command	25°	38°

Accommodation, for Officers and Crew—I have assumed that a complement of 400, all told, would be a sufficiently numerous crew for such a ship, inasmuch, as the complement for the "Captain" now completing at Birkenhead is to be but 400. Yet there is ample space for a complement of 500, if necessary. The complement of the "Royal Sovereign" is but 300.

The poop is fitted up for the accommodation of the Captain and principal Officers, and has direct communication with the lower deck, which is fitted up for the other Officers and the crew in the usual manner, and the forecastle for petty officers and the hospital.

Ventilation is provided for by means of the iron tripod masts; the Turrets with through communication to the spar-deck; hatchways through forecastle and poop; and also by the side-tube scuttles, as at present fitted, or scuttles through the Monitor deck, as in the "Miantonomoh."

The capstans for heaving the anchors are worked by steam, as in the "Royal Sovereign."

In the holds there will be space to spare, as not more than one-half the present quantity of stores and provisions would be required. The spar-deck affords sufficient space for working the ship under sail, tting the anchors, stowage of boats, &c., clear from the fire of the rrets beneath.

I will not enter into a refutation of the statements prepared by e professional Officers of the Admiralty, and made by the late ecretary to the Admiralty in laying the Navy Estimates before arliament in 1867, but content myself with referring you to the llowing table, which gives my estimate of the weights of the Duncan" *converted,* compared with the estimate of the weights of the essels of the "Invincible" class, and of a turret ship of the same ize and power proposed by the professional Officers of the Admiralty.

C.

General Particulars.	Admiralty.		Monitor, Duncan.
	Invincible.	Turret-ship.	
Length	280 feet	280 feet	252 feet
Breadth	54 „	54 „	62 „
Mean draught of water	22 „	22 „	25 „
Tonnage, b. m.	3,774 „	3,774 „	3,727 „
Displacement	5,899 „	5,947 „	6,268 „
Area of sails in square feet	25,813 „	25,813 „	29,404 „
Port sill above load-water line	8 „	11 „	7 ft. 9 ins.
Weight of one broadside	1,250 lbs.	1,600 lbs.	3,600 lbs.
Horse power	800	800	800
Speed in knots	13½	13½	12½
Complement	450	·450	400
Armour on ship's sides	8″ and 6″	8″ and 7″	7½″
„ turrets or battery	6 inches	7½ inches	6 inches
Thickness of backing	10 „	10 „	18 „
„ plating behind armour	1¼ „	1¼ „	= 1½ „
Height of belt above load water line	4 feet	8 feet	4 feet
Thickness of plating on deck	5/16 ins.	¾ ins.	1½ ins.
Weight of water, provisions, officers' stores, &c.	204 tons	204 tons	191½ tons
„ masts, yards, rigging, &c.	158 „	158 „	202½ „
„ cables, anchors, boats, and Warrant Officers' stores	141 „	175 „	195 „
„ armament (total)	389 „	264 „	414 „
„ engines, boilers, and water „ engineers' stores, galley, &c.	830* „	830* „	598½* „
„ auxiliary engines	25 „	25 „	None.
„ coals	450 „	450 „	550 „
„ Total equipment	2,147 tons	2,106 tons	2,151½ tons
„ hull (and conning house, if any)	2,740 „	2,455 „	2,857½ „
„ armour on ship's sides and bulkheads	850 „	850 „	619½ „
„ backing	140 „	140 „	145½ „
„ turrets (without guns, &c.)	None.	397 „	491 „
Total weight complete for sea	5,877 tons	5,948 tons	6,265 tons

* The machinery in the Admiralty vessels includes surface condensers, &c., and is consequently much heavier than that of the "Duncan," which is not fitted with

You will observe, that the total weight of equipment of "Invincible" is 2,147 tons, and that of "Duncan" converted 2,151½ tons; now, it is not a necessity of my proposal, that this 2,151½ tons should be apportioned, as in column 3, it might without prejudice to my plans be made to approximate in detail to that of the "Invincible."

Now, this question of *weights* has invariably been made the *stalking-horse* of the Constructor's Department, for excluding designs and proposals emanating from private ship-builders.

For instance, in the Return, designs for ships No. 26, session 1867, most of the objections taken were on account of weights.

The Thames Company's ship was said to be 104 tons under the mark; that from the celebrated firm of Samuda Brothers, 255 tons under the mark.

And in this proposal of mine for converting the "Duncan," the professional Officers of the Admiralty make out, that the ship would weigh, if converted as proposed, 803 *tons* (*!*) more than I have estimated (in table C), thus—

My estimate of "Duncan," converted, complete for sea, is	6,265 tons.
Estimate by the professional Officers of the Admiralty, complete for sea, is	7,068 "
The actual weight of "Zealous," complete for sea, is	6,027 "
The actual weight of "Royal Oak," complete for sea, is	6,400 "
The actual weight of "Ocean" or "Prince Consort," complete for sea, is	6,600 "

Thus, *they* make the "Duncan" (converted) 1,041 *tons heavier* than "Zealous," 668 *tons heavier* than "Royal Oak," (of the "Prince Consort" class, which are 20 feet longer), and 468 tons heavier than "Ocean," or "Prince Consort," which are 20 feet longer, are plated all round to the height of upper deck, their engines are 200-horse power greater and heavier, and they carry more coal.

How, or in what manner it is managed to create this additional 803 tons, I am at a loss to discover. What inference is to be drawn from this most extraordinary discrepancy?

Offensive Powers.—The armament is to consist of six of the heaviest

surface condensers, &c. The total weight, therefore, of the "Duncan" converted complete for sea is 6,265 tons. Her total weight complete for sea as a 90-gun line-of-battle ship is 5,950 tons. The weight of the converted ship is therefore 315 tons heavier; the requisite buoyancy for this additional weight is obtained from the displacement resulting from the doubling, backing, and thickness of armour, and by immersing the ship 3½ inches deeper in the water. Still, however, leaving the "Monitor" deck 4 feet 3½ inches above the load line of floatation, the mean draught of water when thus completed for sea being 25 feet. The actual weight at the sides of the converted ship would be *less* than at present in the 90 gun line-of-battle ship with all her guns at broadside, the transverse strain, therefore, will be *less*. Moreover, the two sides are strongly connected together by the iron plating on the deck and sides (in the converted ship), and the weights in the centre of the ship are well supported by *pillars* from the keelson under every beam throughout the ship.—C.F.H.

guns obtainable (say 600-pounders), two in each turret; also two 70-pounders on the upper deck.

The weight of broadside from turrets = 3,600 lbs.
" " "Bellerophon" = 1,250 "
" " "Hercules" = 1,600 "
" " "Invincible" = 1,250 "

The whole broadside of six guns—3,600 lbs., has a range from afore and abaft the beam of 104.° (See Diagram No. 4.)

Two guns can fire ahead within 10° of keel
" " astern "

DEFENSIVE POWERS. (See Diagram No. 3.)

"*Invincible.*"	"*Duncan,*" *Monitor.*
Main deck battery :— **6" armour, 10" teak-backing.** **2—⅝" skins, and 10" frames.**	**6" armour, 18" teak-backing.** **1½" skin on 10" plank.** **13" frames and 8" plank.**
Upper deck battery :— **6" armour, 7½" teak-backing.** **2—½" skins, 7" frames.**	

The 8" plates at load-water line, in the "Invincible" class, extend only about one-third of the length of the ship in midships, 15 inches above and 21 inches below the load-water line.

Excluding the frames in each case, and taking 1" of wood to equal ⅙ of an inch of iron, we have defensive powers of

"Invincible," at load-water line = 10⅞ in. of solid iron.
"Duncan," monitor " = 12 in. of solid iron.

Steadiness of Gun-platform.—The practical experience derived from the "Royal Sovereign" and "Miantonomoh," affords good evidence that the "Duncan," converted as proposed, would prove very steady in a seaway.

The "Royal Sovereign's" maximum angle of rolling has never exceeded 11° each way, and it has been stated that the "Miantonomoh" rolled only 7°. The absence of rolling in Monitors is, by Captain Coles, attributed mainly to the weights being central, and their lowness of freeboard; but I believe that much more depends on the disposition of weights than the absence of lofty sides (if not armour-plated); for it is well known that the "Achilles" is almost, if not quite, as steady in a sea-way as the "Miantonomoh."

We have already seen, that as regards disposition of weights, the moment of inertia in the broadside-ship would be over *five times* greater than in the turret-ship.

And in reference to this question, an observation of Admiral Warden's is worth noting; he says, "on the 26th September, 1866, the "'Lord Clyde,' with a force of wind No. 6, was rolling during the "whole forenoon from 22° to 23°, and the average maximum roll from "8 to 12 o'clock, was from 26° to leeward and 21° to windward; the "rolling, though deep, was easy, the *peculiarity* being, that the ship "appears to *dwell*, at the end of the roll on each side, more than is "*usual* with ordinary ships."

This *peculiarity of dwelling* at the end of each roll, is the natural result of the enormous comparative "moments of inertia" of the heavy, lofty, iron-clad sides of these broadside-ships when once set in motion by the wind or waves.

Let us now compare the experience of the broadside-iron-clad, "Lord Clyde," with that of the converted line-of-battle ship "Royal Sovereign." The section of "Prince Consort" is sufficiently like "Lord Clyde" for illustration. (See diagram No. 3.) Admiral Warden says (on the 20th September, 1866). In the "Lord Clyde," although "the "precaution was taken of battening down the maindeck hatches fore "and aft, and only five guns on the port side were cast loose, it "was found utterly out of the question to fire at the target in any "other position *than* when head on to the sea; and the time occupied in "firing 15 rounds was about three-quarters of an hour. It was necessary to steam round the target once or twice to bring the guns to bear "when the ship *rolled* to 28 degrees, whilst it did not exceed 10° to 11° "when head to sea.

"The *result* was, that the main deck was flooded with water to the "extent of flowing over the hatchways; the water poured in and out "of the guns, two shot rolled overboard out of them, and one was followed by the cartridge. Two of the guns at different times got the "better of the crew, and banged in and out of the port several times "with extreme violence, and two of the slides were to a certain extent "damaged by it.

"It is needless to say that the practice was wild in the extreme, nor "do I believe that at any time there was the least probability that "we could have hit any enemy's ship, *except* by accident or miracle."

The gallant Admiral then put the question—"Could a turret-ship of "*equal size* and power have done better, or have proved herself more "efficient in powers of offence and defence?" and replies:—

"I think there are some considerations which would lead to this "question being answered in the affirmative.

"Suppose the turret-ship chose, or was obliged to take up a position "where the broadside guns of this ship would bear on her when they "could be fired, the *result* would be that the main deck of the 'Lord "Clyde,' and the Monitor deck of the turret-ship would be both flooded "alike; but the advantage would, as I think, still remain with the "turret-ship. The sea might, and probably would, wash right over "the deck of the turret-ship, but the water would be got rid of, "whilst in 'Lord Clyde' it is not at all clear that it *could* be got rid "of, and certainly, not as fast as it would accumulate.

"The guns being amidships on the line-of-keel, would not be subject "to such violent motion, and therefore more easily managed, and make "better practice. Moreover, it is not conceivable that the turret-ship "could roll so as to destroy the cartridges in the guns; whereas "in 'Lord Clyde,' the larger portion, if not all, would be so destroyed."

Reporting on the performance of the "Royal Sovereign," Captain Sherard Osborn says (between the 28th August and 17th September, 1864), "I was on ten different days under weigh in the Channel, and tested the vessel in weather ranging from a perfect calm, with heavy swell, to a double-reefed topsail breeze, and a smart sea.

"On all occasions she behaved remarkably well; her extreme rolls have only been 11° each way.

"The turrets and guns work admirably; we have now fired in all 177 rounds, under all circumstances; and I believe I see my way to firing by night from a turret with as much accuracy as by day, so long as the enemy is visible.

"I am of opinion that the 'Royal Sovereign,' as she now stands, is the most formidable vessel of war I have ever been on board of."

The only objection appears to have been that, "when riding at anchor in bad weather, the *drift* and *wet* blow along the deck in a very trying manner, severely punishing those exposed in charge of the watch." This also was the complaint against her when at the recent Volunteer Review at Dover. In the violent storm on that occasion, "no protection could be found on the upper deck from the violence of the weather, or the tons of water that 'skeet' over her fore and aft. Under such circumstances Officers and men suffered considerably."

This objection is entirely obviated in the proposed plan of conversion, by the spar-deck, poop, and forecastle; notwithstanding which, two guns can fire, either ahead or astern, within 10° of line of keel. Further, Captain Chamberlain, so late as 20th May, 1868, says:—

"I was present on board the 'Bellerophon' the day she fired at the 'Royal Sovereign,' and I was forcibly struck by the fact that, frequently the 'Bellerophon' could have got *no gun* to bear upon the 'Royal Sovereign' *anywhere*, whilst there was not a moment, so far as I could see (except when the 'Bellerophon' was right ahead or astern) that the 'Royal Sovereign' could not have brought *all* her guns to bear at choice upon any spot on the 'Bellerophon' which was in sight."

"It appeared to me then, and *the conviction remains on my mind*, that the 'Royal Sovereign' *is* BY FAR *the more formidable machine* of the two."

I may here remark that, the height of the lower port-sill of the battery guns of the "Bellerophon" is 8 feet 9 inches, with only 400 tons of coal on board; with her full complement of coals, 600 tons, the port-sills would be about 8 feet 3 inches above the water; the port-sills of the "Duncan's" turrets would be, with 550 tons of coal on board, 7 feet 9 inches.

Endurance.—With reference to the endurance of the screw line-of-battle ships, I cannot do better than give you the opinion and experience of one of the most practical and experienced master shipbuilders of Her Majesty's Dockyards, who, writing to me under date 27th March, 1869, says:—

"I am of opinion that with proper care and ordinary repairs, they will "last from 30 to 35 years.

"To give an idea of the durability of our line-of-battle ships, I will "quote the following ships, viz., 'Nelson,' 'Prince Regent,' and "'Rodney.'

"I saw the 'Nelson' launched at Woolwich, and 45 years subsequently I converted her from a sailing-vessel to a screw steam-"vessel at Portsmouth; she is now on the Australian station.

"I saw the 'Prince Regent' launched at Chatham in 1822, and "in 1860 I converted her from a sailing to a screw-liner at Portsmouth.

"The 'Rodney' was built at Pembroke in 1833; in 1853 she formed "one of the Channel squadron, at that date I docked her at Portsmouth "to repair her false keel. She has been subsequently converted into a "screw-liner, and was lying in the ordinary at Sheerness in good "condition in 1866.

"When I cut down the 'Royal Sovereign' I did not find a bad "timber in her frame. Many liners have been broken up not because "they were rotten, but because they were considered obsolete."

Stability.—Much confusion with regard to this term has at times arisen for want of a common understanding as to its proper meaning, perhaps on account of its being generally considered in the light of a mere abstract mathematical problem; but the view taken of it by Captain Fishbourne commends itself to my mind as the most definite and intelligible, and I see no objection to its adoption in the mechanics of naval architecture.

He divides stability into hydrostatical and hydrodynamical.*

At rest, two ships may have equal hydrostatical stability, but when in motion, the practical or hydrodynamical stability may be greater or less in one than in the other.

In general it has occurred that those ships which have a comparatively large measure of hydrostatical stability have rolled much, and thence it has been inferred that stability was the cause, whereas the cause of rolling has been the large moment of inertia of the heavy and lofty iron-clad sides, for where the moments of inertia are large, the practical or hydrodynamical stability is small; some people imagining these two stabilities to be identical have been led into this error.

Diagram D has been headed "Stability of Monitors under Canvas," but I do not now propose to enter into that general subject, observing, however, that Monitors, if properly constructed, are quite capable of carrying a proper equipment of sails, the only difficulty I see, is how to work the sails conveniently without a spar-deck.

But with respect to the "Duncan," converted as proposed, it will be my object now to prove to you that she would possess more than sufficient stability, and be perfectly safe if fitted with her present sail equipment.

---

* When the word stability is used, it is intended to denote practical or hydrodynamical stability. When the term moment of stability is used, it is intended to denote moment of hydrostatical stability. *Hydrostatics* is that branch of mechanical science which treats of the nature, gravity, pressure, and equilibrium of fluids, and of the weighing of solids in them. *Hydrodynamics* is that branch which relates to the motion of non-elastic fluids, and the forces with which they act upon bodies opposed to them.—C.F.H.

Statical, or more properly hydrostatical stability depends on the relative positions of the *metacentre* and *centre of gravity*.

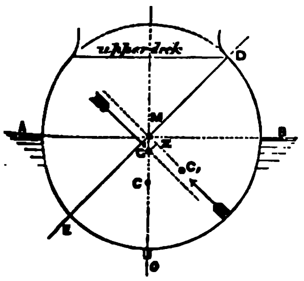
Allow me briefly to illustrate this in the following diagrams:

No. 1 is a section of a cylindrical form to the upper-deck, A B the line of floatation when at rest, G the centre of gravity, and C the centre of buoyancy. G, the centre of gravity, retains its position under every circumstance. Now let us incline this cylinder until D E becomes the line of floatation; C will then become the centre of gravity of displacement or buoyancy; the upward pressure of the water drawn through C will intersect the vertical MO in M; that point is called the metacentre, and the distance between G and M, the metacentric measure of stability. It will be obvious that there are now two forces brought into play, tending to restore the cylinder (or ship) to its vertical position, first the upward pressure of the water through the centre of buoyancy C, and the downward pressure of gravity through G, and since the weight and buoyancy are constant, whatever the angle of inclination may be, the distance GZ, the arm of the righting-couple or lever, multiplied by the total displacement or weight of ship, will be the *measure of hydrostatical stability*.

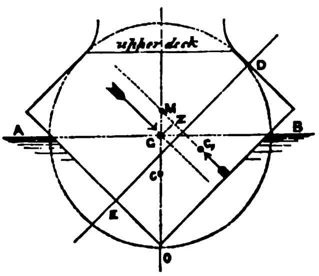
But if the centre of gravity be at M, it is clear the upward pressure of the water through C, and the downward pressure of gravity through M, would be in the same line, the one balancing the other, there would in that case be no tendency to return to the vertical, there would exist no *stability*.

The above applies in general to No. 2, although of a different form.

No. 1.



No. 2.



The position of the metacentre (M) results from the breadth of beam and displacement; the greater the breadth of beam in proportion to displacement, the higher the metacentre; the higher the metacentre, *cæteris paribus*, the greater the moment of stability.

The centre of gravity of the ship is the centre of gravity of all its component parts, and equipments.

The height of metacentre above load-water line in—

"Prince Consort"	of 6,696 tons displacement, and	58′ 5″ beam, is	3·860′
"Achilles"	„ 9,484 „ „	58′ 3½″ „	1·437′
"Duncan" (convtd.)	„ 6,268 „ „	62′ 3″ „	7·58′

The centre of gravity of the total weight of the—

"Prince Consort,"	of 6,696 tons weight, is	2·150′	below load-water line.
"Achilles"	„ 9,484 „ „	1·571′	„ „ „
"Duncan" (convtd.)	„ 6,268 „ „	1·510′	„ „ „

The metacentre, therefore, above the centre of gravity, which is a comparative measure of hydrostatical stability in similar ships, is in—

"Achilles"	3,088 feet.
"Prince Consort"	6,010 „
"Duncan" (convtd.)	9,080 „

According to this measure the "Duncan" converted would possess 50 per cent. greater stability than "Prince Consort," and 200 per cent. greater stability than "Achilles;" but the weight of the ship forms the more important item in this question of hydrostatical stability as the following table of comparative moments of stability at indefinitely small angles of inclination will shew.

	Breadth of Beam.	Weight of Ship.	Metacentre above centre of gravity.	Moment of Stability.
Conqueror	55′ 6″	5,777 tons	× 4·889	26,514
Achilles........................	58′ 3½″	9,484 „	× 3·088	29,287
Orion..........................	55′ 9″	5,101 „	× 6·127	31,257
Prince Consort.................	58′ 5″	6,696 „	× 6·010	40,243
Duncan converted..............	63′ 3″	6,268 „	× 9·080	56,913

Now, because in the "Achilles" this distance between the metacentre and centre of gravity (G M) is comparatively small, it has been assumed by some as being an infallible indication of steadiness, and "that her power of carrying canvas has been sacrificed in procuring "her exemplary steadiness."

It will, however, be seen by reference to table II, that no sacrifice of power of carrying sail has been made, and that she would carry quite well a fourth more sail power than she has at present.

Even if in another ship, this distance (G M) were "nearly such as "it is in ships notorious for their easy movements at sea," such as the "Achilles," it would afford no sure and certain ground for assuming or inferring steadiness, for in the case of the "Orion" and "Prince Consort" this distance (G M) is the same, yet the "Orion" is considered to behave well at sea, while the "Prince Consort" is one of the worst rollers in the Navy.

In further illustration, let us take the case of the "Prince Consort." (See Diagram No. 3.) Suppose we take out her engines of 1,000 horse power, and substitute engines of 800 horse power; this will give us, say, 200 tons altogether (with coals, &c.). Now let us convert this 200 tons into an armour-plated Sponson battery, and place it on the upper deck (like the "Invincible"); this would result in raising the centre of gravity and in making the distance between it and the metacentre (G M) approximate more nearly to that of the "Achilles;" but, as I have already shewn, such an operation would simply cause the "Prince Consort" to roll even more heavily and deeply than she does now. It is clear, therefore, that this distance (G M) affords no infallible data for inferring steadiness.

Digressing for a moment: I was considerably surprised to find that a somewhat similar operation had actually been performed on board the "Pallas," to see if it would cause her to roll less heavily and deeply. It is well known (from Report, Channel Fleet, 1866) that "the 'Pallas,' "when steaming at 5 knots, wind 5 to 6, long moderate head sea, on "the 21st September rolled 34° one way and 34½° the other, although" (Admiral Warden states) "there was neither sufficient wind nor sea to "account for such a prodigious result. She had never previously "exceeded 33°, but that point or something approaching to it was "reached sufficiently often to justify me in saying that the extent to "which she rolls generally must be considered as a very grievous and "unfortunate defect."

From Report, Channel Fleet, 1868, it appears this "grievous and unfortunate defect" was attempted to be alleviated by placing 50 tons of iron ballast on the upper deck, and shifting 6 tons of shot from the shot lockers and round the lower deck to the tiller compartment, abaft the after ward-room.

But as the state of the weather during the whole of the 33 days' cruise was exceptionally fine, with very light winds and smooth water, it was not favourable for bringing out the full effect of this alteration. Yet there is conclusive evidence in the account of her rolling during this cruise that, under similar circumstances as the cruise of 1866, her rolling would have been simply exaggerated.

Again, in the case of the "Caledonia" as at present, and as if converted into a turret-ship, in both cases the hydrostatical (or statical) stability would be the same, that is, the centre of gravity and metacentre would remain in the same relative positions.

But in the case of the turret ship, the hydrodynamical stability would be greater by reason of the smaller moments of inertia, as we have already seen, which would lessen the extent and violence of the rolling.

It is clear, therefore, in the case of the "Duncan," converted as proposed, that she would have a large amount of hydrostatical and hydrodynamical stability, *i.e.*, would stand well up under her canvas, and would not be a heavy roller.

But, before proceeding further, it is well that I should endeavour to prove to you the correctness of the position of the centre of gravity of the "Duncan" converted.

There can be no doubt about the position of the centre of gravity of the "Prince Consort," for it was ascertained by actual experiment. Its position is shewn on Diagram No. 3. The "Prince Consort," be it remembered, was a sister vessel to the "Duncan," was cut down, lengthened about 20 feet, the decks were lifted about 2 feet, she is fitted with engines of 1,000 horse power, and is armour-plated all round to the height of the upper deck, and her total weight, including equipments, is 6,696 tons.

It is known also by practical experiment the position of the centre of gravity in the line-of-battle ships. It was only necessary, therefore, in deducting the weights removed, to deduct their corresponding moments, and in adding the new weights, to add their corresponding moments; two independent calculations were made, the one shewing the centre of gravity to be 1·75 feet below the line of floatation, the other 1·510 feet below. To be on the safe side, I took the latter; probably it would be found by actual experiment to be a little lower, but that it is not situated higher is corroborated by the practical experiment on the "Prince Consort." A glance at Diagram No. 3 will shew that such must be the case, especially when we remember there are no lofty iron-clad sides extending all round the ship.

Having now, I trust, shewn the correct position of the centre of gravity of the total weight of the "Duncan" converted (viz., 6,265 tons), I will now proceed to shew—

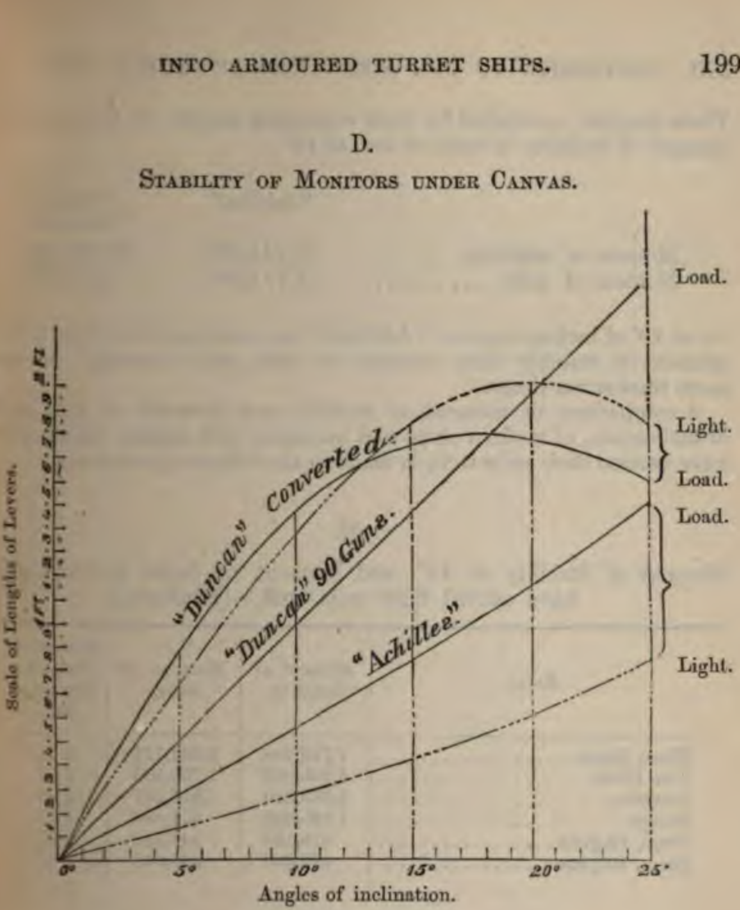
1st. That the moment of sails at any time would not be greater than the maximum stability of the ship, in fact, much less.

2nd. That the combined influence of the wind and the rolling of the ship at any time would not be greater than the stability.

The following diagram represents the length of the lever, or arm of the righting couples, at the various angles of inclination, at the ends of which the weight and buoyancy of the ship act to return her to the upright position.

D.

STABILITY OF MONITORS UNDER CANVAS.



"DUNCAN" CONVERTED (LOAD).

Inclination.	5°	10°	15°	20°	25°
Moment of stability........	11,934,272	20,639,270	24,837,326	25,160,253	22,675,116
Moment of sails with a fresh breeze, all plain sail set	2,720,000	2,703,697	2,658,121	2,594,608	2,594,042
Moment of stability greater than moment of sails	4·4	7·6	8·5	9·7	9·0

Thus, at 10 degrees of inclination the length of the lever in the "Achilles" is ·55 feet, and in the "Duncan" converted 1·47 feet.

These lengths, multiplied by their respective weight of ship, give th moment of stability in units of lbs. at 10°.

	"Achilles."	"Duncan" (converted.)
Moment of stability	11,744,320	20,639,270
Moment of sails	2,771,340	2,703,696

So at 10° of inclination, the "Achilles" has more than four times great moment of stability than moment of sails, and "Duncan" converte more than seven times.

A comparison of moment of stability and moment of sails, at 1 of inclination, of modern ships and ironclads with sailing vessels whic have carried their sails well, is made in the following table:—

H.

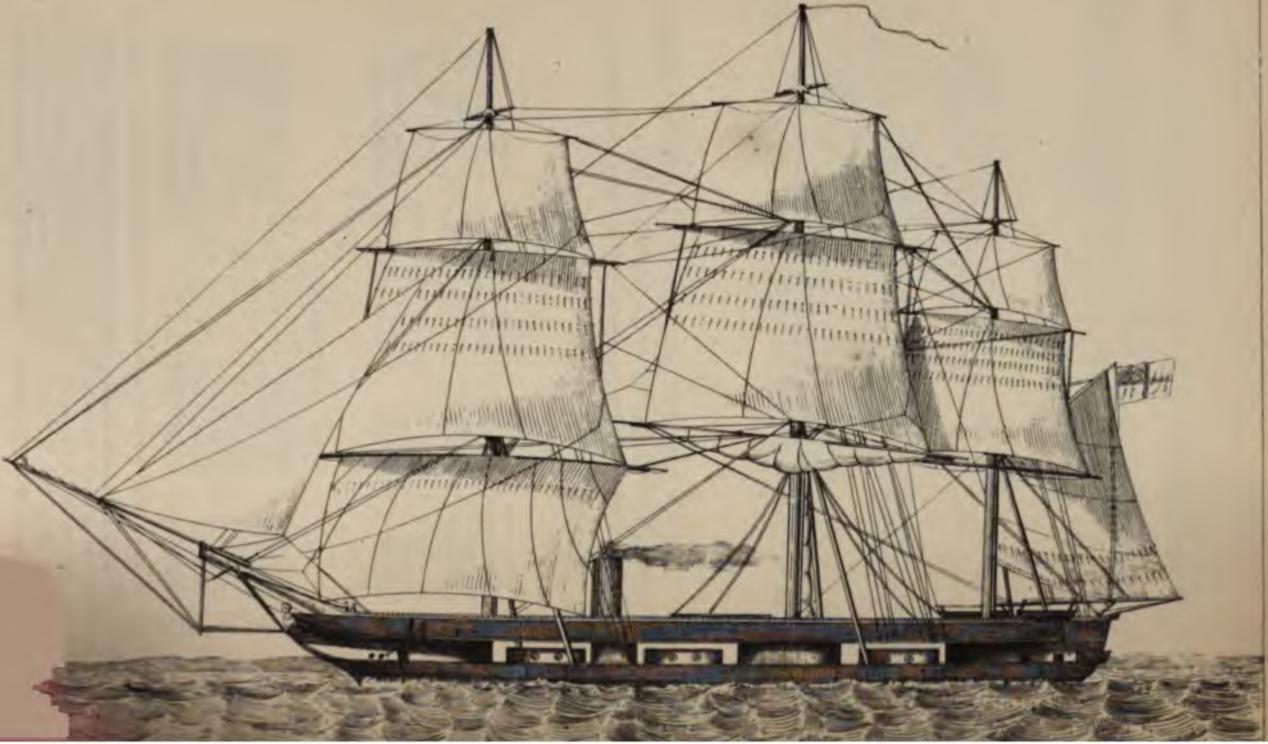
MOMENT of Stability at 10°, and Moment of Sails, in Ships whic have carried their sails well.—(Fincham.)

Rates.	Moment of Stability.	Moment of Sails.	Moment of Stability: Moment of Sails.
Three Decks....................	7,732,480	2,632,121	2·94
Two Docks	4,945,920	1,750,165	2·82
Frigates.........................	3,689,280	1,276,577	2·89
Sloops	1,225,280	554,484	2·21
Brigs, 18 guns	916,160	442,418	2·07
Brigs, 10 guns	463,680	247,645	1·87
COMPARED WITH.			
Conqueror......................	10,310,720	2,871,300	3·59
Duncan, 90 guns	12,761,280	2,871,300	4·44
Orion............................	12,178,880	2,871,300	4·23
Achilles.........................	11,744,320	2,771,340	4·23
Prince Consort.................	15,650,880	1,741,984	8·99
Duncan converted	20,639,270	2,703,691	7·64

NOTE.—Suppose a sufficiently strong boom, extending from the ship's side to distance of 50 feet from the centre of gravity of the ship, it would require a weigh at its extremity of 92 tons to heel the "Conqueror," to an angle of 10 degrees; 1 tons, "Duncan," 90 guns; 108 tons, "Orion;" 104 tons, "Achilles"; 1[illegible] to "Prince Consort;" and 184 tons, "Duncan," converted as proposed.

And at 20° of inclination the length of the lever in the "Achilles" i 1·175 feet, in the "Duncan" converted is 1·792, which multiplie by their respective weight of ship, gives the moment of stability i units of lbs.—

Diagram Nº 5.



	"Achilles."	"Duncan" (converted).
Moment of stability	24,978,240	25,160,253
Moment of sails	2,662,011	2,594,608

So also at 20° of inclination, the "Achilles" has more than nine times greater moment of stability than moment of sails, and the "Duncan" converted, nearly ten times. But I will now endeavour to shew you that no steady wind nor sudden squall would cause her to incline to even 10°.

Diagram No. 5 represents the "Duncan" converted, and under all plain sail, except that the main course is not set.

SAILS COMMONLY SET "BY THE WIND."

No.	Winds.	Pressure in lbs. per square foot.		Sails.
		from	to	
1	Light airs	·006	·050	Courses, topsails, top-gallant sails, royals, spanker, jib, flying jib, and all light sails.
2	„ winds ...	·090	·140	Ditto ditto ditto
3	„ breezes ..	·200	·270	Ditto ditto ditto
4	Moderate „ ..	·360	·450	Ditto ditto ditto
5	Fresh „ ..	·560	1·270	Royals and flying jib taken in, in a seaway, to two reefs in the topsails.
6	Strong „ ..	1·450	2·270	Single reefed topsails, and topgallant sails, in much sea, two reefs in topsails, to taking in top-gallant sails.
7	Moderate gales ..	2·500	3·540	Double reefed topsails to treble reefed topsails, reefed spanker and jib.
8	Fresh gales	3·800	5·100	Close reefed topsails, reefed courses, to taking in spanker, jib, fore and mizen topsail.
9	Strong gales	5·440	6·940	Reefed courses, close reefed main topsail, fore staysail, mizen trysail, to taking in the mainsail.
10	Heavy gales.....	7·340	9·000	Close reefed main topsail, storm staysails to storm staysails only.
11	Storms.........	9·530	13·630	

The calculated moment of sails is always reckoned at 1 lb. on the square foot of sails, of "all plain sail," a fresh breeze, No. 5, 12 knots an hour. Yards braced in a line with the keel to receive the full impact of the wind.

Now, at an inclination of 5°, the

Moment of stability is	11,934,272, and
Moment of sails	2,720,000

The pressure of wind on the square foot of "all plain sail" to inclin the "Duncan" to an angle of 5° would be 4·4 lbs., which forc equals wind No. 7, moderate gale, 25 knots an hour.

But with wind No. 7—a moderate gale—"all plain sail" would n be set, but only *double-reefed topsails, courses, fore-topmasts, stay-sail,* a *double-reefed spanker;* therefore, with this reduced amount (o moment) of sail, being one-third less with wind No. 7, she would n nearly approach to even 5° of inclination.

For referring to the report of Channel Fleet 1864, under Admi Dacres, on the 2nd and 3rd of March, with the force of wind about all the ships, "Edgar," "Warrior," "Black Prince," and "Defenc were under reefed sails, and even with that force of wind, on March "Defence" split a main topsail and topgallant-sail, and carri away some spars.

When sailing at about six points "near the wind," with the yar braced at 25° with the line of keel, the wind will then strike the s at an angle of 42°.

In a "strong breeze" (2 lbs. on the square foot) at 42°, the obli impulsion would be to the direct as ·543 is to 1; even the whol this force will not be exerted to incline the ship, but the part only acts perpendicularly to the longitudinal axis of the ship; the for the oblique impulsion must, therefore, be reduced according to co-sine of the angle which the sail makes with the longitudinal axi the ship.

The co-sine of 25° = sin. 65° = ·906, and the moment of sails (all p sail), 2,740,452; consequently, we have (inclination of ship not b taken into account) ·534 × 2 lbs. × ·906 × 2,740,452 = 2,630,884— pressure of the wind on the sails to produce the inclination.

The moment of stability at 2° is	5,264,000
Moment of sails, all plain sail, with No. 6 strong breeze (2 lbs. square foot), sailing six points near the wind, yards braced 25°, is	2,630,884
Moment of sails (4 lbs. square foot), No. 7 moderate gale, sailing six points near to wind, yards braced 25°, is	5,261,668

Therefore, if all plain sail could be carried with No. 7 mode gale (4 lbs. on the square foot), the "Duncan" converted would heel to 2° only, *i.e.*, when sailing six points near the wind.

There is no probability, therefore, that, under any circumstances wind, considering the enormous preponderance of stability, the ve would ever be inclined by the force of wind even to 5° of incli tion, and certainly not to 10°.

Then as to the second point, What is the probable maximum a of inclination under the combined influence of wind and waves? have seen that the maximum angle of rolling of the "Royal So reign" never exceeded 11°, and there is every reason to believe t these converted ships, having great practical or hydrodynamical bility, would roll less, and prove even more steady in a seaw We will assume, however, she would roll to 11°, and at that inst a sudden squall caught the ship, say with sails set for No. 5 or 7 wind, if the sails did not split and give way, the effect would be to heel the ship to three or four degrees more, say to 15°, at which angle the moment of stability is 8½ times greater than the moment of all plain sail.

It will, I think, be apparent, therefore, that no combination of wind and waves, is likely to cause an inclination so great as 15°, for, be it remembered, these converted Monitors would not roll so heavily, nor so deeply, as the lofty iron-clad broadside ships.

A very confident writer on naval matters has stated that these converted turret-ships would capsize in a gale of wind; but there is no limit to which wild and nonsensical theories may be carried if assumption be admitted as the basis.

For example, if we *assume* the centre of gravity to be at M (Diagram No. 3), there would be no stability at all; and, of course, the higher the centre of gravity is *assumed* to be, the less would be the stability. If we *assume*, also, that the sails won't split, and the spars won't give way, why, under all these *assumptions*, which may be applied to the "Bellerophon," or even "Achilles," it might be demonstrated on paper that they even would capsize in a gale of wind.

But in all such matters we must be guided by experience, not mere theory—facts, not imaginations.

Spare Buoyancy.—The Monitor deck being 4 feet 3½ inches above the load line of floatation, provides for a large amount of spare buoyancy. The requisite amount of buoyancy to float the ship when equipped for sea is 219,380 cubic feet, and the spare buoyancy, viz., that comprised between the load line of floatation and the Monitor deck is 45,300 cubic feet, *i.e.*, a margin of buoyancy of 25 per cent.

The term *sea-going* was, I think, pretty well defined by the Secretary of the Admiralty—as a vessel which could go to sea and remain there for weeks; the requirements for such are much greater than for a mere harbour vessel, and would be somewhat less than for an ocean cruizer; but I do not intend these vessels as ocean cruizers, but simply as improved "Royal Sovereigns," suitable for Mediterranean or Channel service.

It has also been asserted that twenty-five of these converted ships together would be unable to cope with even one such ship as might be built new for one-sixth the cost, *i.e.*,

Twenty-five converted ships would cost	£2,500,000
One-sixth would be..	425,000

barely the cost of one "Bellerophon;" but this one wonderful ship, which was to be superior to twenty-five converted ships, was to be plated with 15 to 16 inches of armour, to carry 22-ton guns, and steam at 15 knots an hour. This vessel, however, still remains in the airy regions of imagination, although I observe the proposed two new Monitors somewhat approach to it in thickness of armour and in guns; but, alas! for the speed, the splendid 15 knots has dwindled down to 12½ knots, in spite of the enormous power of 5,600 horses to propel them.

The following table gives the general particulars of the proposed new Monitors and improved "Hotspur:"—

	New Monitors without Sail Power.	Duncan, without Sail Power.	2nd Hotspur small Sail Power.	Duncan, full Sail Power.
Tonnage	4,400	3,727	3,200	3,727
Draught of water	25 ft. 6 ins.	25 ft. 0 in.	25 ft. 6 ins.	25 ft. 0 in.
Horse-power	800	800	700	800
Speed in knots	12½	12½	12	12½
Coals carried	1,750 tons	550 tons	350 tons	550 tons
Consumption at 10 knots for	12 days	7 days	3½ days	7 days
Guns	4 of 25 tons	4 of 25 tons	2 of 18 tons	6 of 25 tons
Weight of broadside	2,400 lbs.	2,400 lbs.	800 lbs.	3,600 lbs.
Height of Monitor deck above load-water line	4 ft. 6 ins.	4 ft. 3½ ins.	1 ft. 6 ins.	4 ft. 3½ ins.
Armour on sides	12 ins.	12 ins.	11 ins.	7½ ins.
" on deck	2½ ins.	=2 ins.	2 ins.	=2 ins.
Crew	250	250	200	400
Cost	£286,000	£100,000	£195,000	£100,000

The particulars in fourth column are of "Duncan," as proposed to be converted; second column shows what might be produced by conversion, and by giving up the spar-deck, poop, forecastle, and sails, which, however, I consider would be most *undesirable;* not only on account of the comfort and convenience of the crew, but I am of opinion that all vessels of war, except mere harbour-defence-vessels, should be able to proceed to their destination without the aid of steam and expenditure of fuel. In the case of these new Monitors, they would have to be towed, or to tow a collier after them to enable them to proceed to any distant station.

The following table gives the state of Navies in the year 1840, little more than a quarter of a century since:—

STATE OF NAVIES IN 1840.

	Ships of the Line.	Frigates.	Smaller Classes.	Total.
England	120	130	307	557
France	54	65	213	332
Russia	50	38	60	148
Holland	18	26	50	94
America	18	16	40	74
Sweden	13	15	60	88
Spain	15	18	40	73
Austria	3	8	61	72
Denmark	5	8	20	33
Portugal	4	6	40	50

The state of Navies at the present time is taken from official statements, and is as follows:—

Official Statements of Strength of Navies in 1868-9.

British Navy. Total, 113 vessels of all classes—

47 Ironclads (including three old floating batteries).
12 Screw ships of the line and frigates.
3 Inconstant, Active, and Volage.
12 as Blanche } Amazon class.
2 as Druid } Amazon class.
12 Wooden gun vessels.
17 Composite gun vessels.
8 Heavy corvettes.

French Navy. Total, 332 vessels of all classes—

50 Ironclads.
96 Screw steamers.
91 Despatch vessels and Tenders.
95 Transports, various.

United States' Navy. Total, 206 vessels of all classes—

52 Ironclads.
95 Screw steamers.
28 Paddle steamers.
31 Sailing vessels.

Italian Navy. Total, 94 vessels of all classes—

22 Ironclads.
22 Screw steamers.
22 Paddle steamers.
6 Sailing vessels.
12 Screw transports.
9 Paddle ditto.
1 Sailing ditto.

I have not been able to obtain a detailed list of the French and American Navies, but give our own navy in detail, as to ironclads; the three floating batteries, making a total of 47, are excluded as worthless.

PRESENT IRONCLAD OCEAN FLEET.

Built.

No.	Name.	Length.	Tonnage.	H.P.	Cost.
		Feet.			£
1	Agincourt	400	6,621	1,350	450,233
2	Minotaur	400	6,621	1,350	462,441
3	Northumberland	400	6,621	1,350	435,971

No.	Name.	Length.	Tonnage.	H.P.	Cost.
		Feet.			£
4	Warrior	380	6,019	1,250	360,995
5	Black Prince	380	6,019	1,250	364,647
6	Achilles	380	6,019	1,250	458,571
7	Hercules	325	5,234	1,200	450,000
8	Bellerophon	300	4,270	1,000	459,098
9	Ocean	273	4,047	1,000	285,821
10	Caledonia	273	4,125	1,000	299,491
11	Prince Consort	273	4,045	1,000	249,207
12	Lord Clyde	280	4,067	1,000	342,733
13	Lord Warden	280	4,080	1,000	408,705
14	Hector	280	4,089	800	288,146
15	Valiant	280	4,089	800	316,705
16	Royal Oak	273	4,056	800	259,442
17	Royal Alfred	273	4,068	800	339,226
18	Zealous	252	3,716	800	256,221
19	Resistance	280	3,710	600	247,333
20	Defence	280	3,720	600	241,168
21	Penelope	266	3,096	600	240,000
	Building.				
33	Monarch	300	5,102	1,100	366,000
34	Captain	320	4,272	900	335,000
35	Sultan	325	5,226	1,200	450,000
36	Audacious	280	3,774	800	250,000
37	Invincible	280	3,774	800	250,000
38	Vanguard	280	3,774	800	250,000
39	Iron Duke	280	3,774	800	250,000
40	Triumph	280	3,893	800	250,000
41	Swiftsure	280	3,893	800	250,000
42	Repulse	252	3,749	800	256,000
	PRESENT NONDESCRIPT FLEET.				
	Built.				
22	Pallas	225	2,372	600	244,[illegible]
23	Favourite	225	2,094	400	180,7[illegible]
24	Research	195	1,253	200	75,1[illegible]
25	Enterprise	180	993	160	66,[illegible]
26	Waterwitch	162	778	160	58,[illegible]
27	Vixen	160	754	160	67,555
28	Viper	160	737	160	52,476
29	Scorpion	224	1,833	350	110,969
30	Wyvern	224	1,899	350	116,[illegible]
31	Royal Sovereign	240	3,765	800	180,4[illegible]
32	Prince Albert	240	2,529	500	225,84[illegible]
	Building.				
43	Glatton	245	2,709	500	250,000
44	Hotspur	235	2,639	600	250,000

Ocean fleet built, 21 in No.	£7,225,252
„ building, 10 in No.	£2,907,000
Nondescript fleet built, 11 in No.	£1,341,961
„ „ building, 2 in No.	£500,000
Total first cost ships and engines, in 10 years	£11,974,213

Throwing aside the "smaller classes" of ironclads and unarmoured vessels, which are, perhaps, as numerous to-day as in 1840, we have ocean ships of war, built and building .. .. 31 in number.
as against ships of the line, and frigates of 1840.. 250 „

If our maritime position was satisfactory, and what it ought to be in 1840, the question is, is it now, in 1869?

Have we a fleet such as this empire ought to possess for its own security?

The general opinion is, I believe, that our maritime defences are very far from being in a satisfactory condition; and the late Secretary to the Admiralty, in July last, confirmed this opinion by stating in Parliament that, "We could not shut our eyes to the fact that the "French were getting an *enormous* ironclad fleet together; they were "already on an *equality* with ourselves." This statement was further endorsed by Admiral Sir John Hay, a few months later. "It was "found," he said, " when the late Admiralty took office, France had "six ironclads more than we had, but they decided at once to redress "the balance."

This country is now, therefore. merely *on a par* with France as regards maritime power, whereas but 25 years since we were nearly twice as powerful as France, four times as powerful as Russia, and eight times as powerful as America.

It is clear, therefore, that our maritime power has fallen enormously from what it was a quarter of a century since.

Mr. Cobden, who was assuredly not the least zealous of the friends of peace, or the least rigorous and acute of the critics of our naval expenditure, once declared his conviction that the British Navy should always be, *at least*, the match for *any two navies* that could be brought against it.

What, therefore, should be done to place this country in its proper position promptly, efficiently, and economically?

It is universally admitted that there exists at the present time no one type of ship-of-war which it would be desirable to perpetuate. There are good qualities in some which are not possessed by others. In some thick armour and heavy guns, but wanting in speed and ocean-going qualities; while others have a maximum of speed and ocean-cruizing qualities, but are lacking in maximum effective guns and thickness of armour. The *typical ship* on which to found our *future navy* has not yet been built. And as each vessel of the "Hercules" and "Sultan" class will cost roundly half-a-million of money, and require at least three years to build and equip, any large addition to our Navy may well cause us to recoil, for 12 vessels of the "Hercules" or "Sultan" class would cost about £6,000,000, and require six years to build and equip; and considering the rapid progress made within the last ten years in the science of attack and defence, it is probable that before they would be completed, they would have become comparatively obsolete and ineffective, as so graphically portrayed in a leading article on the Naval Review at Spithead, in July, 1867—"If," said the *Times*, "ten "years has been sufficient to antiquate one division of the fleet (the "unarmoured screw line-of-battle ships), may not another ten years "do the same for the other (the broadside ironclads)? In this case, "our regrets will be more poignant, for these ironclads are even more "costly—running away with half a million a piece," and concludes, "even if we must have ironclads, and nothing but ironclads, cannot "we have them on more reasonable terms?" Seeing, therefore, the enormous outlay in money and the time involved in supplying the country with merely twelve *new* ironclads, and considering that we are in a transition state as regards our Navy, is it wise to build more vessels, costing from a quarter to half a million a piece, not only until those at present built and building have been fairly and honestly tried, their defects discovered, and improvements suggested; but until a Royal Commission shall have decided—

1stly. By an examination of the most eminent and experienced of our naval officers, as to the most efficient type of ship of war for the several services of the country (for they are undoubtedly the mo proper judges as to the various requirements of such services).

2ndly. By an examination of the most eminent and experienced o the naval architects of the country, as to the best means of efficient and economically embodying such requirements, as may be determin on by the Royal Commissioners, in future ironclads, whether for co harbour, or special service. And

3rdly. The number of each class necessary to maintain our marit pre-eminence?

And pending such enquiry by a Royal Commission, to utilize at moderate cost those of our screw ships of the line, which are ciently sound, by converting them into sea-going "Monitors" or i proved "Royal Sovereigns;" for these ships are ready to hand, could be converted in a short time at a moderate cost.

It will have taken just ten years to supply the country with ocean fleet of ironclads, 31 in all (including 21 built and 10 building at a cost of £10,182,252—this is at the rate of three annually, and an average cost of £326,782 a piece. Even at this rate, to add 1 ships to the Navy it would take four years, and cost £3,921, while the 12 line-of-battle ships, in the following table, might be co verted into improved "Royal Sovereigns," as this model, in one y and cost but £1,200,000:—

SCREW LINE-OF-BATTLE SHIPS.

Proposed Fleet of Transition.

Name.	Length.	Tonnage.	H.P.	When Launched.
	Feet.			
Victoria	260	4,121	1,000	1859
Howe	260	4,127	1,000	1860
Marlborough	246	4,000	800	1855
Prince of Wales	252	3,994	800	1860
Duncan	252	3,727	800	1859
Gibraltar	252	3,727	800	1860
Each of the above fitted with 3 double-barrelled turrets.				
Atlas	245	3,336	800	1860
Renown	245	3,336	800	1857
Revenge	245	3,336	800	1859
Donegal	240	3,245	800	1858
Defiance	255	3,475	800	1861
Anson	245	3,336	800	1860
Each of the above fitted with 2 double-barrelled turrets.				

The first cost of the above 12 ships is about	£2,500,000
The value of the above 12 Ships, at Shipbreaker's value	£120,000
Cost to convert „ „	£1,200,000
Value of „ „ when converted	£3,921,384

Resulting in a nett saving of £2,721,384, in addition to placing the country promptly in a more efficient state of defence.

APPENDIX.

OPINION OF ISAAC WATTS, ESQ., C.B. (LATE CHIEF CONSTRUCTOR OF THE NAVY), TO ADMIRAL E. P. HALSTED.

(Extract from a Letter, August 24th, 1866.)

"We know not what the result may be of passing events, but we "should not omit being prepared for the worst. A fleet such as "England may require cannot be provided in a day: we ought hence "not to lose a moment.

"Henwood's plan would enable us to provide, in a comparatively "short time, a number of useful ships for the protection of the "country and its commerce, until better ships, such as you propose, "can be procured. And as it is almost entirely iron work which "would be required in the conversion, ships might be sent to such

" firms as Napier's, Laird's, and others, for reconstruction. The dock-
" yards alone would not be equal to the occasion.

" The more I reflect on Henwood's plan, the more I am convinced
" that, on the whole, the arrangement is excellent. For many stations
" the ships would be as good as could be desired."

The CHAIRMAN: Would any gentleman like to make any remarks, or to ask any questions in order to elicit additional information? I should like to ask, first of all, what are the poop and forecastle composed of? Next, how far the fire of the turrets is interfered with by the tripods? Next, what is the security for men on the monitor deck? Then, are these masts instead of tripods?

Mr. HENWOOD: No; iron tripod masts. It is all iron joined together in the centre.

The CHAIRMAN: Is there any rigging at all?

Mr. HENWOOD: Yes, rigging to the topmasts.

The CHAIRMAN: But none on the hull?

Mr. HENWOOD: Not on the lower part of the hull. The tripods form the shrouds for lower masts.

Admiral Sir EDWARD BELCHER: I would make one or two remarks, if you please, upon this subject. In building a wooden ship, she is calculated to bear the strain of the woodwork of which she is composed. Her riders, her ribs, are all calculated, if the vessel should take the ground, to support her whole frame. But if a vessel of the "Royal Sovereign" class, not entirely constructed of iron, should take the ground, we should witness what is constantly occurring with wooden ships. No wooden ship has yet been constructed that when she leaves the dock does not rise amidships—she becomes, to a degree, hogged, and all builders meet that difficulty by giving the vessel, as it were, a lift at either end. Now, if a vessel in dock, shored up and covered with Mr. Henwood's iron-plating, had her shores knocked away, I think it would be found, as I believe it did take place in the "Royal Sovereign," that a rise of a certain number of inches rather alarmingly would take place in her midships. But if Mr. Henwood's vessel took the ground, and came upon the ground with all her force, she would inevitably drive her bottom in. To sustain the quantity of iron which is placed upon our iron-clads, it is necessary that all the parts of the vessel should be calculated to sustain the great weight placed upon their sides. As far as the metacentre is concerned, and as far as, in plain language among seamen, rolling is concerned, I have probably tried that point to a greater extent than any naval Officer. I commanded a bomb-vessel. She had ten tons on her upper works, at least on a level with her main deck, as a bomb; in that ship I carried with me to sea a heavier weight of boats on her upper deck and out to her extreme side than a line-of-battle ship usually carries. I carried two decked vessels, 36 feet long and 10 feet beam, coppered and everything complete. I carried two line-of-battle ship carvel cutters, of 25 feet on the quarters. I carried eight boats altogether. So dangerous did it appear to Sir Michael Seymour that he said he would not allow me to hoist the boats in; he insisted upon their being hoisted in and placed on my deck with the shear-hulk; and all the captains in Portsmouth in 1830 came to see the thing done. As soon as I was away from the shear-hulk I hoisted them out, rigged them, and sent them to Spithead. I was in that vessel in heavy gales, and she never felt the weight of those boats. That vessel was only 350 tons. The next vessel I had, the "Samarang," was 600 tons, and she had a precisely similar set of boats. Yet, running in very high latitudes in the Southern Ocean, going before the wind at 12 knots, a man was washed out of the main chains, but that ship was stable enough to tack, and allow the life buoy to be brought under her lee. But the man who had been struck was killed. Therefore, it does not follow because a naval constructor—(I am a naval constructor myself; I have had my hand to the tools, as well as other men)—says a ship is uneasy, the ship in the hands of a competent Officer may not be quite easy. There is the case of the Bellerophon. The Bellerophon of old in a calm rolled her masts away, and she was never brought to sail until the late Admiral Hawker had the command of her under Sir Richard

Keats. Then she was so much improved in sailing, in weatherly qualities, and absolute deficiency of rolling, that there was not a frigate that could have competed with her. We chased three of the fastest American privateers. They escaped us by mere chance, but we outran them; we could have captured them if it had not been for the fog on the bank of Newfoundland. The objection to Mr. Henwood's ship is, that it is almost basket-work. The vessel is cut away upon her sides, and all that which should support her upper deck fore and aft is removed; she becomes a basket. She has not the power of the "Royal Sovereign" of firing directly ahead and directly astern or an all-round fire; and in four cases on the broadside the tripods would interfere with the guns. And not only that, those guns will not fire clear of the tripods, and you must allow an angle of at least five degrees on the other side to prevent the concussion blowing them away. Therefore it is not strictly correct to say the vessel possesses all-round fire. Again, I strongly believe, from what I have seen, particularly in the case of the "Warrior," that guns fired over the upper deck shake the deck on the forecastle and the aft part of the ship very considerably. The "Warrior" was built originally, so Mr. Scott Russell told us at the Institution of Naval Architects, to fire right ahead and right astern; and should it become necessary to defend herself, for she has four ports cut in her transverse section, the bulk heads of her box, it would only require the carpenter to knock away the bulwarks, and she could fire ahead or astern. That is, Mr. Scott Russell would demolish the ship to get his fore and aft fire. When we come to iron-clad vessels, and to turret work, I think it should be a *sine quâ non* that the guns should look right ahead and right astern, and nothing should obstruct them. The two vessels which are now under the consideration of the House of Commons will have that advantage of their guns seeing clear ahead and clear astern. I understand Mr. Reed has declared that he will not divulge what they are to be; but I think from his negative answers we may almost infer that they are to fire right ahead and right astern. The question of expense is, like all other questions that are drawn out upon paper; when you come to pay the bill you will find it is a very different matter. The estimated cost of altering these ships has been declared to be equal to the cost of building a new ship.* In fact, the process is something like re-covering an old umbrella, which is not of much use when re-covered. If we are to have ships fit to represent this country, I think we should build them of iron, in every respect fit for all the purposes of war. I do not believe that any sheathing put on the "Royal Sovereign," or on any other ship, will render her such a ship as the British Navy should trust to.

Mr. Charles Lamport: I do not know whether you extend the courtesy of a hearing to those gentlemen who appear here as visitors. [The Chairman: Certainly.] If so, I will ask your permission to make a remark or two upon what has fallen from Sir Edward Belcher. In the first place, I think the gallant Admiral has fallen into the common mistake of considering that a pound of feathers is lighter than a pound of lead. Now I, as a practical shipbuilder, can see no difference whatever in a certain weight put upon a ship, whether it consists of iron or whether it consists of wood. Mr. Henwood, in his lecture, has clearly shown us that he takes away from the sides even a larger amount of weight than he adds in armour. I am disposed to think that the question of strain upon the structure of a ship will remain very much a question of dynamical force, which Mr. Henwood has explained, or a question of construction in what is added in relation to that which has been taken away. If I understand him aright, he proposes to put on two plates over the deck, each three-quarters of an inch thick, making a total of an inch and a half of iron in that position in the ship, which all nautical men and shipbuilders believe to be the weakest part, and which Dr. Fairbarn most essentially states ought to be strengthened. My opinion is that that amount of iron put into that position may be made, not a source of weakness, but the source of a very large amount of strength to the structure. If you look at the diagrams which Mr. Henwood has put up there, you will see that there is a large amount of teak wood added; and that teak wood, if it is scientifically and properly applied may be also made to increase the strength of the structure. Over this, no doubt, comes very heavy armour. I am not sufficiently acquainted with that to be able to say whether armour may or may not be put on so as to add to the strength of the whole of the ship. But I fall upon the opinion which I ventured first to assert, namely, that the weight added at the sides, if it be not greater than that which is taken away, will not task the strength of the ship more than before. Sir Edward Belcher has spoken of buoyancy, but I think what Sir Edward means is a question of comparative displacement, and that in the one case there is not the sustaining power in water that there is in the other. But I ask you to look at the amount of armour plate, and I also ask you to look at the amount of wood that is put under it; and I venture to say that, taking the whole, you will get a larger displacement of water, and a larger support to sustain the weight than you would before conversion. I think the next point that Sir Edward Belcher brought before us was, that these ships, whatever may be their qualities, are not the ships the British nation ought to trust to. Now, I never gathered from anything Mr. Henwood said that he intended these ships were to be considered a permanent portion of the Navy. He said they were a makeshift, to help us to tide over the interval between our obtaining the hoped-for ship of the future and the present imperfect state of the Navy. I think he put very clearly before us that we, as a nation, require a greater amount of offensive power on the water than any other nation, and that we do not possess that in the degree in which we ought to possess it. He also put before us clearly that we are not in a position to be able to say what is the best form of ship upon which we ought to spend our money. Nautical men are undetermined about that; constructors are at sea still; and those Civil Lords who come down to the House of Commons, and talk about naval matters, are not satisfied about it. So that, in this maze of uncertainty on the one hand, and the impelling necessity on the other, the necessity of having a force equal to cope with the forces of other nations; I think, when Mr. Henwood shows us that we have rotting in our harbours a fleet of ships that may be so strengthened and made serviceable for purposes of war, that he has shown us a way out of a difficulty, as to which all may agree. Mr. Henwood used the term, the "typical ship of the future." I should like to know what that ship is. For my own part, as a shipbuilder, I believe that ship is still *in nubibus*. I believe we shall never get that typical ship of the future; it is perfectly absurd to attempt it. Just for this reason, that we require ships for totally different purposes. I put it to you whether that sort of ship which is the most capable of defending our harbours and coasts, where there is a small depth of water, is the sort of ship that you would consider the best to go to sea? In other words, are the requirements for defence perfectly similar to those for aggression? Then, again, if we go to war, with what countries are we likely to go to war? I am not sure that I am not trenching on a subject which is not before us; but if we do go to war, we most likely will go to war with Russia on account of her encroachments in India, or go to war with America on account of the "Alabama" question. I will only ask your attention for one moment. Consider what we should aim at if we were at war with either of these countries. In order that our commerce may be protected, we must seal up the Baltic; we must send ships there that can keep there, in order to cope with the Russian turret ships. We must maintain our ships there from year's end to year's end. Now, will the box-broadside-armour-clads enable us to do that? I believe not. I believe, if we sent our ships either to the Baltic or to India, in order to preserve our commerce in a war with Russia, that they would become so foul that the Russians would be enabled easily to cope with them in the condition in which they would meet them. Again, if we go to war with America, what should we do if we attempted anything like aggression? Should we send our huge iron-clads to blockade the American coasts? Is it possible to blockade the whole of a sea-board like that of the United States of America? It is absurd to suppose such a thing. We might blockade New York, Boston, and some of the shipping ports, and what then? Our ships must maintain themselves there, and they must be able at all times to sail faster than those vessels which would attempt to run in or run out, or war ships which might be brought to oppose them. If they lay there for twelvemonths would they not become so foul in their bottoms that they must be sent home to this country to be docked? That is a very important question. If Mr. Henwood's ships can only cross the Atlantic—they are copper covered—they might remain there any extent of time.

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* I have tendered to the Board of Admiralty to convert the "Duncan" as proposed for the sum of £100,000, in nine months, and under the usual guarantees.—C. F. H.

Sir Edward Belcher: They cannot be covered with copper.

Mr. Henwood: Yes, covered with copper.

Sir Edward Belcher: Not, if covered with iron.

Mr. Henwood: The armour is sheathed with wood, and then covered with copper.

Mr. Lamport: I admit that chemical action would, to a certain extent, arise; but not so as to render it entirely impossible to use copper. Then we come to another question, the requirements of our ships engaged in commerce. What ships could we look to to defend our mercantile fleet? Suppose we were at war with any small country, the enemy could, if he chose, send to the United States and purchase such vessels as the "Alabama;" and what chance should we have with our present Navy to sweep them off the seas? I put it to you, whether we should not be very much in the same condition that the United States were when a single vessel, the "Alabama," was destroying or paralyzing the whole of her commercial fleet. Then, the typical ship of the future must combine these three qualities. She must be of light draught; must be capable of carrying a large amount of coal, and of going to sea, as a sea-going vessel, for purposes of aggression; must be swifter than anything afloat, be capable of overtaking any vessel that may be brought to compete with her; and this, in order to protect our commerce in every part of the world. If you can build a ship that can combine all these qualities, I say you will be building something which I, for one, do not contemplate as possible. If, on the other hand, we are driven to separate the three qualities into different classes of vessels, surely until this great question is solved, it is far better to take what things we have, and make the most of them. As Shakespeare says, "Better to bear the ills we have, than fly to others that we know not of." If we go to the expense of building enormous ships, such as we hear are intended to be built, we may find out afterwards that they do not answer their intended purpose; and in ten years hence they may be superseded by something better. Surely, it is wiser to use what we have before us than to lay out money in building vessels that may be practically useless.

Sir Edward Belcher: It has always been contemplated that we should run in and blockade an enemy's shores. I am one of those who remember when we blockaded the whole of the French shores and the whole of the American shores; and what we did before, we can do again. And as long as we can build ships for foreign nations, I have the most perfect reliance upon our private yards to furnish us with ships of every description fit to attack an enemy, and to build them in one-half the time that they do now.

Mr. Scott Tucker: I think our thanks are greatly due to Mr. Henwood for the suggestions he has made. I do not think he proposes, or attempts to propose, that which may be considered the best system for the Navy in general, but that which may enable us to make the best use of those vessels which are now rotting in our ports. With regard to an observation that fell from Sir Edward Belcher as to the "basket-work" structure of these vessels, those who know how hulls have been constructed since 1830 are aware that the framework of all timber-built vessels has been so chain-bolted that the upper works are almost as firm as a rock. In the South Kensington Museum there is the drawing of a vessel called the "Amethyst," which was so chain-bolted that, after being twenty-one days and nights on rocks, and having been floated off and taken into dock, her shear was found not to be altered an inch, so firmly was she chain-bolted. I believe the vessels now in our harbours are so firm and so solid that the weight, instead of being brought direct down on the keelson, might be so disposed on the superstructure or framework as to make those vessels, without doubt, very serviceable as convoys and other purposes, as temporary vessels during the time that proper turret-ships of the line are being constructed for the service of the country.

Mr. Mackie, Assoc. I.C.E.: I should like to make one remark upon the structure proposed by Mr. Henwood. I think we are all very much indebted to Mr. Henwood for showing us a practical means of converting our present wooden line-of-battle ships. I do not propose to enter upon that question. But when I hear it said by Mr. Lamport that vessels must be kept on foreign stations in a state free from fouling, in order to be efficient for fighting purposes, and when I hear from Mr. Henwood that the bottoms of his ships are to be coppered, I do feel surprised that naval architects cannot, or will not, pay some slight attention to chemistry and electricity. It is utterly impossible for any iron ship to be sent to sea covered with copper, or with even a sheathing of wood to be covered with copper, and the iron not be deteriorated. If you put those two metals into an alkaline bath like sea-water, the iron must rapidly deteriorate. Some experiments have been tried with zinc sheathing. Zinc is the only metal that will not decompose iron in sea-water. I cannot see why copper should be preferred to zinc, or why zinc should not have a fair chance. Experiments with zinc have been instituted by Government, and why the results of those experiments should not have been made known, or why some practical experiments have not been tried with a view to the application of the zinc to iron ships, I know not. It is well known that the presence of copper in salt water produces a galvanic action, which is quite sufficient to destroy any iron in its immediate neighbourhood. The wash of the waves will produce this action: I have satisfied myself completely as to this by immersing copper plates entirely in salt water, when the action will go on by itself. Therefore, I cannot but notice the danger of putting copper on an iron ship.

Captain Moncrieff: In reference to Mr. Mackie's remarks, it has just occurred to me that there is a material difference between the vessels proposed by Mr. Henwood, and those where a thin coat of wood is interposed between the iron and the copper. By looking at the diagram it will at once be observed that the iron occupies a comparatively small portion of the outer part of the vessel under water; and that all the remainder of the bottom might be coated with copper. The copper might be kept at a considerable distance from any portion of the iron. I believe, at the same time, that electric action would go on to a certain extent. It is well known that even a chain dropped into the sea in the neighbourhood of a coppered vessel will show the effects of this action. I have myself observed this in yachting. In the present case, the iron is within very few feet of the surface; by heeling over the vessel it could be cleansed, and the destruction of so large a mass of iron would be so small that it might almost be overlooked. I have diffidence in expressing an opinion on this subject, but on looking at the diagrams, they at once suggest to my mind the possibility of using both iron and copper together.

The Chairman: Perhaps you will like to reply now, Mr. Henwood?

Mr. Henwood: The first question was about the poop and the forecastle. The poop and forecastle are merely for the accommodation of the Officers and crew, as a means of supporting the spar-deck and tying the two ends of the ship together. Those who know the construction of these ships are aware that all the timbers run up to the spar-deck, and bind the stem and stern of the ship together. There are various reasons for this mode of conversion, because when you cut down, as in the "Royal Sovereign," the whole stern would have to be pulled down and rebuilt up again. With regard to the legs of the tripods being in the way of firing, that is an objection. It is not a new objection; it is an objection that belongs to this system of tripod-masting in turret-ships. I do not see any way of overcoming it. The only way is to fire clear of it, if you cannot do that it must be fired away and come to grief. As to the protection of the men on the monitor-deck at sea, that deck would not be inhabited. The only protection I propose to put round it, are the stanchions. All the work of the ship will be done on the spar-deck, and the working of the sails; in fact, it will be at sea as if that deck did not exist, as far as working the ship is concerned. I think Sir Edward Belcher's remarks have been so thoroughly answered by Mr. Lamport that very little is left for me to say. But I am not sure whether Sir Edward knows that in these wooden ships, since the year 1825, the timbers are all solid in the bottom and bilges, 30 inches of solid wood. And I will correct any misconception in supposing that there is no increase of weight. I do make an increase of weight. But you will see the weight in

Table C is only 6,265 tons, whereas the weight of the "Ocean" is 6,600 tons. Well, she has performed good service, as I pointed out, in the voyage to China. She has no strengthening whatever, she is merely a cut down line-of-battle ship, with armour plates hung on the sides; whereas in this case I plate the whole of the deck and the side with 1½ inch iron plates, connecting both with a strong angle-iron so that I make that deck as strong, comparatively, as an iron-bound cask. Then, in addition to that part of the ship, which I mainly look to for strength, I have the additional tie of the spar-deck. I should remark that the hammock-berthing is formed of box girders, with plates running down at intervals, so that I get an enormous strength in the spar-deck.

The Chairman: Is this an iron deck here?

Mr. Henwood: Yes; the Monitor deck.

The Chairman: Does that tie the two sides together?

Mr. Henwood: That ties the two sides together.

Mr. Lamport: What is the present weight of the "Duncan?"

Mr. Henwood: The present weight of the "Duncan" is 5,950 tons. The weight of the "Duncan" converted is 315 tons more than the weight of the "Duncan" as a line-of-battle ship. (See foot note to Table C, page 189.)

Mr. Scott Tucker: What weight of gun do you propose?

Mr. Henwood: 600-pounders when they are made. I have allowed for six 25-ton guns.

Captain Beamish, R.N.: Do you think the spar-deck will stand the firing of 600-pounders?

Mr. Henwood: I was going to make a remark about that. Some experiments have been made on the "Prince Albert" at Plymouth. The "Prince Albert" is an iron turret ship: the Admiralty built over her a very slight spar-deck. They fired her guns, with a bucket of water on the top of the spar-deck. The concussion merely shook the bucket of water, and spilt very little. The deck was very weak indeed. They have since put a larger deck, and made it stronger; and the result is so perfectly satisfactory to the Admiralty that I believe they have no fear at all about it. With regard to firing right ahead and right astern, of course that is obtained in the "Royal Sovereign," but is not obtained here. A ship is a compromise; and this converted ship is more of a compromise than a new ship. You sacrifice the right ahead fire that you have in the "Royal Sovereign;" but then you have the convenience of this poop and forecastle for the comfort of the crew, for catting the anchors, the hawse-pipes, and various other things. One thing compensates for another. With reference to Mr. Lamport's remarks about the typical ship of the future, I think I stated that there would be different classes of ships. There would be the ocean cruizer and the harbour defence vessel. But all this would have to be first determined by the Naval Officers. It is their place to say what is the engine of war they require, to perform the service which the country demands of them: then it is for us mechanicians to see what sort of engine we can construct to fulfil such conditions. Then, as to coppering iron plates, I know there is a good deal of objection to that; but I am not sure whether it would not be possible to sheathe the iron with zinc. Of course, in connection with copper, zinc would consume much more rapidly; but we might provide for that by bringing the zinc down lower and putting a thicker strake in. But that is quite an open question, which practice only can solve. I think these are all the objections that have been made.

Captain Burgess: There is one question that I should like to ask, viz., what would the "Duncan," if sold for old material, fetch?

Mr. Henwood: As regards the sale of the ship, I believe the selling price would be £10,000.

Captain Burgess: What is her tonnage?

Mr. Henwood: She is about 3,700 tons; the selling price would be about £10,000, including engines and everything on board. She cost about £200,000.

The Chairman: I am sure the meeting will join me in thanking Mr. Henwood for his lecture on a very important and interesting subject. I myself heartily wish that he may have an opportunity of trying one of these ships, for if he does not succeed the first time, the nation will benefit by the trial. As to the typical ship of the future, there is an old story about a Jack of all trades. Now we must have various trades; that is to say, we must have inshore ships, and we must have sea-going ships. I do not think the requirements of one will answer the requirements of the other. But I think we shall at last get the best sort of ship if we go on making these trials; and as we have so much good material in our harbours, I will not say rotting, though I wish they would rot rather than that we should burn them in our fires. It has been a heart-breaking thing to Officers who have sailed in these ships, and who know them to be as fine ships as were ever built by the hand of man, to see them actually of no use at present, and to know that they are being burned in our fires in London. I cannot help thinking that something might be made of these ships; therefore I am grateful to Mr. Henwood for giving us his ideas on the subject of their conversion. I for one think there is a great deal that might be tried for the benefit of the country.

SMITH'S LIFE-SAVING-BEDS OR MATTRASSES.

Mr. Henry Smith exhibited one of these beds or mattrasses, and explained its construction and use as follows:—

The outer covering is of a strong waterproof material, the stuffing being of rye-straw.* It is 6 feet long, by 2 feet wide, and has life lines firmly attached to the sides. These beds can, of course, be made of smaller dimensions to suit ships' berths, sofas, &c..

Their utility in case of shipwreck, fire, or collision at sea is obvious, the floating power of each bed being more than adequate to bear up a man, and will allow of his changing his position, and so give relief in the case of being in the water for any length of time. Any number of them can be fastened together, and thus form a raft of great buoyancy, and capable of sustaining an immense weight.

One great advantage of these beds is, that from their being filled with rye-straw, they will not sink, if pricked or torn, the air contained in the straw giving them great powers of floatation, whereas an accident of this kind in the case of an ordinary air-inflated bed, would prove fatal. Upon being thrown overboard the wind acting on the bed or mattrass will take it ashore; the tidal influence cannot retard its progress, this has been proved by practical experiments at Black Pool on the West Coast.

Several experiments have also been made on the Serpentine, off Chelsea pier, and also off London Bridge, to prove the power of floatation of these mattrasses. In one case, a man floated on one, his weight depressing the mattrass about 1 inch. In another, a mattrass supported six men in the water, who, by holding on to the sides, were enabled to keep their heads and shoulders above the surface.

My hope is that these mattrasses may gradually supersede those in present use in cabins and berths, and also the stuffed horse-hair bottoms of sofas, &c., on board ship. In the event of a wreck, every mattrass thrown overboard would form a life-buoy, and a number fastened together, a life-raft.

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* Any material containing air can be substituted for rye-straw.—H. S.

Evening Meeting.

Wednesday, April 14th, 1869.

Major-General Sir H. C. RAWLINSON, K.C.B., F.R.S., in the Chair.

NAMES of MEMBERS who joined the Institution between the 5th and 14th April, 1869.

ANNUAL.

Ommanney, Frederick G., Esq., Navy Agent.	1*l.*
Fulton, John, Lieut.-Colonel late Indian Army.	1*l.*
Ardagh, J. C., Lieutenant, Royal Engineers.	1*l.*
Rowley, Charles J., Captain R.N.	1*l.*

THE NORTH-WEST FRONTIER OF INDIA.

By George Campbell, Esq., Bengal Civil Service.

I do not pretend to lay before you any new discoveries with regard to the geography of the countries which are the subject of this paper, or any very minute details, but I must begin by a reference to what I may call the broad practical features of the geography, and that I think, I may best and most briefly submit in a pictorial form; that is to say, I have constructed a coloured map* showing in a somewhat glaring style the features of the countries to the north-west of India.

It may be generally said that the whole of that portion of the globe lying between the interior of India and the frontier of Europe is characterized by extremes.

It is a region in which great plains alternate with very high mountains, the highest in the globe. On the north-west, within the limits of India, we have an enormous plain; beyond that, we have the prodigious mountain system, of which only a small portion can be considered to form part of India; then again we have another great plain in which flow the Oxus and Jaxartes, otherwise the Amor and Syr, and within which lies the great salt lake, called the Sea of Aral, where those rivers lose themselves. This plain reaches to the Caspian and the Ural Mountains. The country we know as Turkistan. On the other side of the mountains you have another great plain forming what was Chinese Tartary, and is now called Eastern Turkistan. More directly to the west, we have somewhat less gigantic but still very great mountain chains branching out from the main system, and again the smaller plains of Seistan and Khorassan.

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* It being impossible to re-produce the coloured maps referred to in the paper, a general map of part of Central Asia is prefixed for reference.—G. C.

The position of the enormous mass of elevated land expressively called by the Easterns "Bam-i-dunya," the "roof of the world," is sufficiently indicated for my purposes by the blackest colours in my map. You will observe that the most compact, and best defined portion of the mass may be said to lie between Kokan on one side, and Kashmere on the other, and it is to that portion that the term "roof of the world" has been applied. Kashmere itself, a mere valley lying between mountains 15,000 feet high on one side, and 25,000 on the other, is no terminus to the high land, which is in fact continued with an undiminished elevation far to the east towards the frontiers of China. I have only omitted to mark the elevation here to so great a breadth, because in these parts we know little of it beyond our own frontiers, and it is beyond the limits of my present subject.

It is the fashion to speak of these elevated portions of the earth as table lands; but I believe that to be a mistake. It certainly is so as respects all those parts which we know. The high lands of the earth almost invariably consist of a succession of ridges, and that is very markedly the case as respects the highlands of Central Asia to which I more particularly refer. We have but mountain beyond mountain, and ridge beyond ridge. Any route across them shows a series of constant and sudden variations of altitude. In respect to the lowest point of the passes one minimum seems as it were to be maintained, below which the ridge at no point descends. The highest peak yet measured—it has been supposed the highest in the world—is on the frontier of Nepal, about 29,000 feet; but it seems to be yet doubtful whether it may not yet be displaced by some portions of the second or interior range between India and Turkistan, called the "Karakorum," which we are now exploring, and where our surveyors have already measured as high as 28,278 feet. It may be said that in the whole length of the range, it can nowhere be crossed without ascending over and over again to a height little less than 20,000 feet. The traveller in fact passes through a succession of gaps in the higher ridges, the crest of the gaps or passes themselves being 18,000, 19,000, and 20,000 feet high. So far as we know, about 19,000 feet may be taken as the minimum height at which the range may be crossed. Between the ridges, the traveller dips several thousand feet lower, sometimes to tracts level by comparison, or it may be that he must descend to the deep gorge of the Indus, the bottom of which in the direct line between Kashmere and Yarkund is only some 7,000 feet above the sea.

From the "roof of the world" the "Hindoo Koosh" range stretches to the west. Of the first portion we have no measurements, and scarcely any knowledge. The passes have never been traversed by any one but rare native travellers, and from their accounts, we may assume that their height and character does not differ materially from those of the main range. In the parallel of Cabool, we first come to more practicable passes. Hereabouts, are one or two gaps, the heights of which are as nearly as we have been able to ascertain about 15,000 feet. And a little farther east we have the famous pass of "Bamean," which is somewhat lower, and which has long been used for mercantile and military traffic.

Like all other routes across the mountains, this "Bamean" pass is really not one pass, but a succession of at least four passes, over as many successive ridges of nearly equal elevation. The highest pass in the route is entered as 12,480 feet in Walker's latest map, where another pass in the same route is put at 12,190 feet, and a third at 11,320 feet. For our purposes we may take the maximum heights of the road to be about 12,000 feet.

To the west of Bamean the mountains rise again. It is not very clear whether the reason is physical or political, or both combined, but at any rate, these mountains have not within historical times been open to any ordinary traffic, and it may be said, that west of the "Bamean route" there are no available passes from Turkistan, till you come to those leading to Herat.

Here the mountain chain, without disappearing, is much diminished in height. About Meshed, it seems to rise somewhat again, but for some distance on the east of Meshed, towards Herat, and again to the west of Meshed, towards the Caspian, the country is certainly less difficult, till we reach the higher ranges of Persia again. There is no cessation of the hilly country, but on either side of Meshed there are tracts through which the mounted Turkmans can and do ride in plundering forays into Persia; by which Herat may be approached; and by which occasional caravans travel.

Both east and west of Cabool, the Hindoo Koosh joins or approaches the high ranges forming the proper Affghan country. The mountains to the south of the gorge leading up to Cabool are 15,000 feet high, the outer range known as the "Solimanee" ranges from 10,000 to 12,000 feet; the routes farther to the west are throughout not less than from 7,000 to 8,000 feet; and the unknown country between, is no doubt very high and difficult. Still farther south in Belochistan, the hills are not quite so high, but are barren and inaccessible in the last degree. They are traversed by two or three passes, of which the "Bolan" is the easiest and most famous. It rises to a height of 6,000 feet, in a course of about 60 miles through a succession of defiles between Dadur and Quetta. Between Quetta and Candahar is a pass, 7,500 feet high, called the "Kojuck."

Not less important than the elevation, is another view of the physical geography, the supply of water; and I have depicted in green the tracts watered and habitable. From about the parallel of Lahore westwards and northwards, it may be said that all the way till we come to European limits, the rainfall is so scanty, that neither crops nor grass can be raised in any quantity, nor can human life be supported, except by artificial irrigation.

Interior India is well watered by the south-west monsoon, and the partial want of cultivation, there shown, is due to hills; till farther north, the supply failing, there is a scantiness of water. The monsoon of Eastern India, deflected by the Himalayas, comes from the south-east to the north-west, a rain-bearing current which gradually diminishes in volume, and hugs the face of the Himalayas. To this is due some fertile country immediately north of Lahore, but with this exception, the nearly rainless character which I have stated, applies not only to the Indian Desert, but also the greater part of the Punjab and Scinde, throughout which, cultivation is confined to the strips within reach of the great rivers.

In the other great plain of Central Asia, even these strips are wanting. It is no doubt due partly to physical, and partly to political causes, that there seems to be very little cultivation on the banks of the Amor and Syr, when they leave the hills and roll through the desert bordered by little but occasional brushwood and jungle. There are petty exceptions here and there; but that seems to be the general character of their course, except at one point about Khiva. There the Amor seems to have at one time altered its course, and there are facilities for irrigation in the Quasi-Delta between the old and new courses, which have given rise to the large Khivan oasis, watered from the Oxus itself.

With this exception, it may be said that cultivation is everywhere confined to the valleys in, or immediately under the hill-country where there are special facilities for artificial irrigation. It is a curious feature of the extreme aridity of the country, that while the greater rivers never reach the sea, the smaller streams never reach the larger ones, but are cut off and absorbed. If you examine the map, you will find this everywhere, a constant succession of streams pointing towards, and apparently designed by nature as feeders of the main rivers, but which never get so far. It is upon these smaller streams that the chief cultivation is found. The cultivated portion of the Khanat of Bokhara itself is not on the Oxus, but on one of those branches lopped off and separated from the parent stem, and is supplemented by another smaller tract on a smaller stream of the same kind. The Khokan territory is on the upper Syr, but it will be seen that it has great facilities for irrigation from the hill country on either side.

Khiva, Khokan, and Bokhara are the three well known oases of the Great Desert of Turkistan; all the rest may be said to be absolutely desert. In Eastern Turkistan again, which is equally desert, we have several oases formed by irrigation at the points where the streams issue from the mountains, Khoten, Yarkund, Kashgar, and Aksoo.

As respects the hilly country between the Deserts of India and Central Asia, I have tried to depict in green all the tracts which yield considerable supplies of food. In the Indian territory we have the great valley of Cashmere, and I have marked the narrow valley of the Indus, and that of its branch the Ghilgit river. We have a good deal of cultivation in the undulating sub-montane country within the salt range, the Rawul-Pindee district; and we have the fine valley of Peshawur surrounded by the Affghan Mountains. Along the foot of the range we have some valleys similarly situated, Kohat and Bunnoo belonging to ourselves, and other small valleys in the hills belonging to the Affghans, and communicating with the plain at points where streams run from the hills. Further south there is a kind of bay in the mountain wall, and I believe a good deal of cultivation in Cutch Gundava belonging to the Beloch Khan of Khelat.

On the other side where the high ranges almost suddenly dip into the Turkistan plain, said even here to be no more than 500 feet above the sea, you have again a succession of valleys between the Spurs, Koondooz, Khulm, and Balk; Andko, Siripool, and Maimana, and the valley of the Murghab, a considerable river eventually lost in the sand.

On the Persian side you have some considerable valleys about Meshed, and where the great range slopes to the plain of Khorassan.

Within the hill country, you have, west of Peshawur, the Jalalabad valley lying low on the Cabul river; farther west the larger and higher valley of Cabul, and the fine well-watered tract at the foot of the higher ranges of the Hindoo Koosh. North of Peshawur, on the streams running from the snowy range to the Cabul river, you have two or three fine valleys, of which Swat and Kuner (called in its higher parts, Kashkar or Chitral), are the principal. Farther south you have a little cultivation about Quetta, and the Pisheen valley, and a fine tract about Candahar and the Helmund, the river running from the northern mountains southwards to the Desert of Seistan. Finally, you have the valley of the Hareroud, in which is Herat.

It is impossible to depict the narrow glens which are scattered in nooks and corners throughout Affghanistan. They are no doubt numerous, and are often very pleasant smiling places; but their culturable area is extremely limited, and with respect to the whole country, this important fact may be broadly stated, that it does not produce a sufficiency of food for its own inhabitants, much less to export or supply food to strangers. Fine a race as the Affghans are, nature having so much restricted their culturable land, they are as a rule very poor, and a large proportion of them are obliged to eke out their subsistence by foreign service or trade. Grain seems to be generally exorbitantly dear at Cabul, as compared with the neighbouring countries; and the city would often be starved, if deprived of supplies from Peshawur and India. There is no such meat supply in the country, as to make up for the deficiency of grain. North-Eastern Affghanistan is certainly not a grazing country. The tribes thereabouts are singularly destitute of flocks and herds. Western Affghanistan is more pastoral, but so far as I know, there is no large exportable surplus produce. India draws neither sheep nor cattle in any large quantities from Affghanistan. The horses called Cabul horses, which are imported in some numbers, come, I understand, from the north-western valleys (which are not really Affghan), where grass seems to grow in great abundance at certain seasons, and where horses are said to thrive better than men. Fruit is almost the only edible exported from Affghanistan. In a great part of the country, dried mulberries are the main support of the population.

I repeat then that the country between the Indus and the Oxus is one in which food is deficient.

I now come to the people of the countries which I have described. I have not attempted to go into the difficult physical question of the gradual desiccation of this portion of the globe, the occurrence of which in some shape, I believe to be a matter of little doubt; but to enable us in any degree to realize the present situation, as compared with that in former history, I must very briefly notice the changes of population.

My belief is, that the world may be divided into two classes, people who are, and people who are not, patient of foreign dominion. Sometimes people, who by no means want military qualities, for example, the Punjab people, nevertheless submit quietly to an equitable foreign rule. To others, mere independence is a passion. More especially in mountainous countries, it appears that the people are either extremely quiet and amenable, or very much the reverse. This we see in a very marked degree in Northern India. Take first the Himalayas, the hill-country between the snow and the plains. It is the most precipitous and defensible in the world, and some of the hill men are among the best soldiers in India. Yet nowhere have we so quiet and easy a hold of the country, nowhere are fewer troops required; nowhere can an unarmed and unprotected European enjoy such safe and pleasant ease, as in the secluded hill-glens. Go but a little farther west to the Affghan country; it is really not so difficult as the Himalayas, and contains some more open valleys; but we know by experience that it requires all our military power to enter a single glen within a short distance of the plain country.

I believe the ancient Hindoos to have been probably a softer race than the more recent immigrants; they were, perhaps, more nearly allied to the modern Kashmerees. The ancient Persians, or to use a wider term, the Iranians, were a cognate race, and the Greek accounts of them sufficiently show that they were not very hardy. Both these races have always easily submitted to foreign conquerors. My point is, that in ancient times these softer races held the country between India or China and Europe, now occupied by more pugnacious tribes; and that in this, is to a great extent, the solution of the easier passage of those regions in former times.

It is certain that some hundred years ago, Hindoo races occupied the valleys of the Cabul river, and the southern slopes of the Hindoo Koosh. The Affghans have acquired most of that country within historical times. There seems to be some reason to suppose that the fertile tracts north of the "Karakorum range" were first colonized by Hindoos, and the name "Kashgar" may be a trace of the connection with the "Kashas" of Kashmere. A mass of evidence shows that the pure Persians were the ancient occupants not only of Khorassan and the north slopes of the Hindoo Koosh, but also of the whole of what we now call Turkistan, where they are still represented by the Persian-speaking Tadjiks and Sarts, a handsome, but soft and subject people. There ancient travellers and conquerors encountered people not difficult to deal with. I take the old distribution of races to have been somewhat as represented in this small race-map.

In modern times not only the people of Persia, and the Northern Hindoos have been hardened by an alloy of Turkish and Scythian blood, and the tribes of the upper Caucasus have been inured to war by long centuries of self-defence, but almost the whole of the country on either side has been occupied by two of the most independent races in the world, the most untameable, and least tolerant of foreign dominion, the Affghans and the Turkomans. The Affghans have multiplied and advanced over the whole of the country south of the Hindoo Koosh, as well as into the valleys to the east; the Turkomans have possessed themselves of the whole of the country on the other side, leaving the Persian races, the Tadjiks and Sarts in a minority in point of numbers, and in political position, absolutely subject. The country may now then be ethnologically described somewhat, as shown in this other map.

The Turkish races are now dominant in the country to the east also. In the farthest points of his conquests or influence beyond the Indus, the Maharajah of Kashmere has come among people who speak pure Turkish, as I myself ascertained by taking down their words. They have possession of the hill country, in which the Amor has its northern sources, and of the petty mountain states north of Balk and Kundooz.

Higher up on the northern slopes of the Hindoo Koosh, Persian-speaking tribes still prevail. On one side of the range seem to be tribes of Indian affinities, the Kaushkar people and Kaffirs, on the other hill Tadjiks of Budakshan. North of Cabul you have the same race in the hilly country. We must not omit notice of the very peculiar people who occupy the higher country west of Cabul, the Hazarahs and Eimaks, who, though they speak Persian, have in their features most palpable marks of a large share of Turanian blood, which they themselves attribute to the settlement of a Mongol colony by Chengis Khan. They have none of the brutal and savage character of the Turkomans; on the contrary, they are a pleasant, industrious, hardworking race, whom one would suppose to be more allied to Thibetan races. Many of them have lately come down to take service on our public works, where they are distinguished as first-rate navvies. Yet they are bold and well skilled in arms, for they have maintained their independence intact against Affghans, Turkomans, and all comers.

The hardy character of the Beloches to the south is well known. It is a curious circumstance that while in all southern and western India, Arab mercenaries have been entertained by the native powers, and even in the Beloch territory of Scinde, yet we learn from Palgrave and other recent travellers, that in the Arab territories in Arabia and Africa, the chiefs habitually entertain Beloch mercenaries to keep down their countrymen.

West of Meshed some Kurd colonies have been settled as a barrier against the Turkomans, and the dominant tribes of modern Persia are a mixed race much more warlike than the old Tadjiks and Sarts of the countries to the East.

In modern days then the whole of the countries between India and northern Europe are occupied by races hardy and independent in the extreme.

It is very greatly to be regretted that since we have had so intimate a knowledge of Affghanistan, and there is so much scattered literature concerning it, the information has never been brought into one focus in any general description of the country and people later than that most admirable work, "Elphinstone's Cabul," the result of a visit to Peshawur in the early years of the century. Elphinstone, indeed, notwithstanding his limited opportunities, has in many respects occupied the ground so fully and so well, as hardly to leave room for another. But the political circumstances have entirely changed since his time, and we can hardly suppose that after years of British occupation there is not room for at least an enlarged and modernized work founded on the basis which Elphinstone has given us. I could wish that we had such a work before the personal knowledge of the Officers of the Affghan campaign is lost.

In Elphinstone's time there really was something of the nature of a Kingdom of Cabul. There was a ruler who claimed the character of King of a considerable country, and was possessed not only of Peshawur and the other valleys on the Indian frontier, but also of Kashmere and the neighbouring hills.

Now-a-days we speak of the country and kingdom of Affghanistan. It seems to be popularly supposed that there is something of the character of a King of that country, and that we may hope to promote the establishment of a strong and settled government of Affghanistan. How far there is a good deal of misapprehension in this idea, I would try briefly to explain.

"Affghanistan" is a mere English geographical term, hardly, if at all, known to the natives. Ethnologically there is certainly a large tract of country inhabited by a very marked race, properly called not Affghans, but Pathans. Politically speaking, the dominion of Cabul by no means includes the whole Pathan country.

At the very highest, the position of a Pathan King could only be compared to that of a King of Scotland in old times, and the state of affairs might be described as an exaggeration of Scotch affairs. The King was but the chief of one of many rival houses—a kind of chief among chiefs—obtaining a very precarious and limited allegiance from the other lowland chiefs, and a scarcely nominal allegiance from the highland clans. The principal difference as compared to Scotland would be, that the highlands of Affghanistan are in larger proportion and more inaccessible; the lowlands more scattered and difficult to rule; the people altogether more insubordinate: and just as a Scotch King never had much real power and authority till he acquired a great foreign dominion in England, and was thence able to bring money and influence to bear in Scotland, so a Pathan King has never occupied a strong position, except when he has had great foreign dominions, and could treat his own country as a mere nursery of followers and soldiers, to be petted and bribed into a sort of allegiance. In these days the ruler has been stripped of his foreign possessions, and even of some of the

Pathan lowland country. He does not pretend to the title of king; and curtailed as he is in power and in means to very narrow limits, it will not be difficult to understand the extreme difficulty of establishing anything like a strong government, except very partially during the dominance of some man of extraordinary personal vigour.

In truth, the Pathans are of all the people in this world the most democratic, the least subject to authority, the most independent. Physically they are one of the finest races created by God; and with them the spirit of freedom and independence amounts to a ruling passion. They are not only intolerant of foreign dominion, but yield scarcely any obedience to their own chiefs. They have none of the Celtic reverence, if such there really be, but rather the Saxon individuality. Elphinstone well describes their popular system of representation, the Jeergas of Clans, and the Sub-Jeergas of Sub-Clans, their allegiance to the community and not to the chief. To him I must refer you for particulars. It is to be feared, however, that even the popular assemblies exercise a very imperfect power. To a great degree, every man is a law to himself, and blood feuds, attended with great loss of life, are chronic among the people. Elphinstone explains their habits and manners, and the difference between the western and the eastern tribes; the former being more pastoral and perhaps also somewhat more amenable to rule; most of the latter purely agricultural, perhaps we might rather say horticultural, and democratic in the extreme.

It must be quite understood that these people are of that class of the human race which has an intense attachment to the land and to fixed property in the soil, as distinguished from the wandering tribal habits and claims of Turkomans, or nomadic Arabs. The difference in this respect between Pathans and Turkomans is as great as between Kabyle and Arab in Algeria. The two races have no sympathies, and nothing in common.

There is yet another distinction among the tribes of Eastern Affghanistan, which it is important to note. The pure Pathans south of Peshawur, with the Afreedees and other tribes of the Khyber, are a people without reverence, not only in politics but also in religion—a hard, energetic, practical people, without imagination, and without much moral sense. Although nominally Mahommedans, I believe that they will cut the throat of a true believer almost as cheap as that of any infidel. All their enthusiasm is political, not religious. But north of Peshawur a mixture of race has told largely on character. This is the country which the Pathans have acquired and colonized within historical times. In Swat and the neighbouring valleys they found an Indian people, whom I suppose to have been allied to the Kashmerees. To this day the Pathans are there a superior race, and there are still inferior people who are not called Pathans. The Pathans have been largely influenced by the blood and intellect of the subject people. The Euzofsies, and other tribes to the north, have thus acquired much of the imagination and some of the reverence of those early Aryan races. They have priests, even pay a sort of tithes to priestly chiefs, of whom the Akhoond of Swat is the most famous.

They are somewhat more polished than their rougher brethren, and are really zealous Mahommedans, sometimes even fanatics. An aristocracy, with serfs to do the inferior work, they are quite equal to the pure Pathans as soldiers. I believe that it is from these clans that the most numerous Pathan colonists in India have been supplied. It is among them that the zealous Indian Wahabees, who have not cared to live under our rule, have found a scanty and not very hospitable refuge (the other tribes would have stripped them of every farthing), and it was against them only, that our last considerable campaign was directed.

In the days of Mahmood of Ghuznee, and the early Mahommedan conquerors, the Pathans had scarcely got so far to the north-east as Cabul. The founders of the early Indian dynasties first established themselves in Ghuznee and Cabul, and drawing the Pathans along with themselves, became, in fact, identified with them; so that the early Mahommedan Empire of Delhi was really a Pathan rule, and eventually became so avowedly.

Again, the Mogul power was first established in Cabul. I do not know whether the word Mogul is really "Mongol." By the people themselves it is applied, not to Mongols, but to the Persian speakers, who form a large section of the inhabitants of Cabul, as distinguished from Pushtoo speakers. There certainly was no considerable Mongol immigration into India. The number of people calling themselves Moguls is few, and there is not the slightest trace of Mongol feature. In fact, the Mogul dynasty too became, to a great degree, intimately connected with Affghanistan, and the Emperors maintained a suzerainty over that country by means of the wealth of India.

To the west, the Pathans have had various relations with Persia, and in the eighteenth century, during the decline of the Mogul power, these relations became very intimate. Early in the century, the western Pathans overrun Persia, and ruled there. Then Nadir Shah turned the tables and conquered them. On his death, Ahmed Shah Dooranee founded the Affghan dynasty, which in some sense subsisted to our day. This dynasty acquired from the declining Mogul Emperors, Kashmere and the greater part of the Punjab, and for a time protected the Moguls against the Mahrattas. When this Dooranee dynasty became distracted and weak, Runjeet Sing and the Sikhs were rising to power. They expelled the Pathans not only from the Punjab, but eventually from Kashmere also, and even from the Pathan submontane valleys, Peshawur, and the rest of the Trans Indus country. Meantime the descendants of Ahmed Shah had fallen in their own country, and remained exiles, except for the short time when our expedition galvanized into artificial life, the fallen dynasty. Dost Mahommed, Chief of the Barukzie clan, rose to a certain power, and wielded it by personal energy, but claimed no higher title than that of "Ameer," or Chief. We succeeded to the position on the frontier conquered by the Sikhs. Finally, Dost Mahommed dying, a disputed succession followed, as a matter of course. Hence the present situation.

I have alluded to the distinction between eastern and western Pathans. At the very utmost the present dynasty can only be described as chiefs of the Western Pathans. Over the eastern tribes they have no more authority than has the Lord Mayor of London. Even over the west they have a very imperfect hold. The proper Pathan country extends to the neighbourhood of Herat; and not only as a question of political arrangement, but also as one of nationality, Herat and the country about it, belong more properly to Affghanistan than to Persia. Yet it is so distant from Cabul, and so separated by the independent Hazareh country, that the ruler of Cabul has generally not been able to hold Herat also; and the latter place was throughout Dost Mahommed's rule held independently by another Chief, a member of the deposed royal family. Even Candahar was not under Dost Mahommed's rule till the latter years of his life.

Thus, then, Peshawur and the Derajat being cut off on one side, and Herat being a very uncertain possession on the other, the present dynasty, even supposing them to be united under one head, are almost confined to Cabul and Candahar, and such nominal allegiance as they have from some of the western tribes. On the east there remains to them little more than two or three small valleys, insecurely held. Over Swat and the valleys to the north, the Ameer has no more authority than over the hill tribes to the south. With so limited resources, it is impossible that the Chief can maintain a large army or considerable state; and he must be a genius indeed who so situated can control and rule over such a people as the Pathans.

I have still to notice the valleys at the northern foot of the Hindoo-Koosh. Tracts so situated must always be an object of contention between the powers in the plains below and those in the hills above. The latter have greater facilities for disturbing the quiet possession of the tenants below, and the powers being anything like equal, it will generally be found that the sub-montane valleys go with the hills. Accordingly, the Pathans long possessed the valleys, both on the side of Peshawur and on that of Balk. When they were weak and divided among themselves, they lost them to the Sikhs on one side, to the Turkomans on the other. When Dost Mahommed was firmly established, he succeeded in re-annexing Balk and Koondooz, and those tracts are still under Pathan rule. The population consists partly of the original Persian-speakers, partly of Affghan colonists, and partly of Turkish colonists. The Pathans seem to have settled in large numbers, and may now be considered to be the dominant race.

In the valleys to the west, a Turkoman population preponderates. They form a succession of small Turkoman states, and the Pathans have never succeeded in establishing power there.

I was one of those who thought that it might have been better to have made the Upper Indus our boundary line. Rivers are seldom boundaries of races, but in this case it happens that it is so. On this side to Attock we have Indians—beyond the Indus, Pathans. The Peshawur valley and other sub-montane tracts are occupied by portions of the same tribes which hold the adjoining hills. I thought that by stopping at the Indus, we should escape constant collisions with the frontier tribes, and that the possession of the sub-montane valleys would both give means to the Cabul ruler, and would make him, as it were, vulnerable on the side of India, since he would hold some of his most valuable possessions open to be seized by us at any moment. On the other hand, it may be that without control over the hill tribes, he could hardly have held with profit, lands east of the Khyber; and our possession of Peshawur, Kohat, &c., has had an important political result, which may possibly be beneficial. It has brought us into extremely intimate relations with the Eastern Pathan tribes, whose geographical and commercial relations are much more with the East than with the West. Not only do large numbers of them serve us as soldiers, but they make what is to them great profit by trafficking with us. They have the freest access to our territories and cantonments; and being by no means a shy or modest or prejudiced people, they avail themselves of it to the very utmost, and never neglect an opportunity where they can, honestly or dishonestly, of earning a penny, or of stealing a penny's worth. In fact with some of the tribes, intimacy amounts to familiarity. On a market day at Peshawur, crowds of the independent Pathans may be seen making themselves thoroughly at home, and a stranger, ambitious of an interview with a noted hero of the Khyber, may be gratified on very moderate terms. Yet it is a curiously one-sided familiarity. They take advantage of all the freedom that we offer, but no European dare show his nose within their borders. This is from no personal prejudice or dislike, but simply from their passionate love of independence and extreme jealousy lest the secrets of their hills should be spied out by the race, whose genius for absorption they dread.

The ordinary punishment for minor offences committed by any hill tribe, is to blockade it, and prohibit the entry into our territory, of the people of the offending clan. More serious cause of armed collision we occasionally have, and always must have—it is a necessity of the situation—but it seems generally to result in a good-humoured kind of fighting, which can be amicably ended when terms are arranged. We never have, and scarcely can have, any general war with the tribes—they are so entirely without union among themselves.

Practically then, it may be said that the relations of the Eastern tribes are with us and not with the Ameer of Cabul. It would be madness to touch their independence, but we have unlimited facilities for negotiating with them, bribing them, and taking them into our pay when occasion requires.

This, however, must always be borne in mind, that the Pathans are a thoroughly practical people, in whom necessity and their peculiar political position has sharpened the wits and developed social astuteness to a remarkable degree. It is generally said by our frontier Officers, that for bold disregard of truth and unblushing fiction in the law courts, a Hindoo is a child compared to a Pathan. Make it worth their while, and we may get from them money's worth. But it is not for an instant to be supposed that we can hoodwink them, *diplomatize* them, gain their favour or affection, or secure them in any way, except for value had and received. They are terrible talkers, and always ready to negotiate and hold forth in the most plausible manner; but you may always be quite sure that they are hard set on getting something out of you. They need money very much. We have a great reputation as good subsidizers. In this view every Pathan Chief is, above all things, anxious to be a friend of the English. The difficulty is, that they cannot control their people, and bargains fall through because the tribes cannot agree among themselves about the division of money received. The Khyber Pass has been closed for years on this account, because the Afreedees cannot agree among themselves; and the communication between Peshawur and Cabul is chiefly through the hills of the Momunds—a more amenable tribe, who have relations with both Governments.

The Beloches to the south are a different people. They are equally or even more predatory, being less attached to the soil, and roam more as wandering robbers; but they are said to be a good deal more amenable to the authority of their tribal Chiefs.

I cannot pretend to give many particulars regarding Turkistan and Tartary. My consolation is, that so far as I can discover, no one else can give reliable details of those countries. We have, from the descriptions of Vambery and others, excellent accounts of the general character of the country and people. But what I mean is, that we have nothing that can be called statistics, or any approach to statistics, giving us any idea of the real extent of cultivated area or the population of the oases which exist in this great desert tract. I find the population of one of the largest Khanats variously estimated by the best authorities at from half a million to three millions. My own impression is, that much of what is said of extent, populousness, fertility, and production, is due to contrast with the wretched desert around, and that *positively* most of the oases are very petty countries. Still the settled tracts of the three well known Khanats, Khokan, Khiva, and Bokhara are, no doubt, in some sense considerable. The oases of Chinese Tartary I suspect to be less considerable. The valleys occupied by the Turkomans on the northern face of the Hindoo-Koosh are certainly but small tracts, and produce more grass than grain.

In the population, a distinction seems to be drawn, in common parlance, between the Turkomans—the wild and utterly untamed robber tribes, who roam over the deserts—and the Uzbegs, the latest conquerors, who now occupy all the settled tracts, and claim a nominal allegiance from the wilder tribes. The fact, however, seems to be, that they are all of the same Turanian race, the Uzbegs being merely the dominant, and, in some sense, more civilized tribe. Of the whole race it cannot too often be repeated, that they seem to be the most brutal, bloody, untameable, slave-dealers on the face of the earth. The word Cossak, or Khazak, is simply Persian for "thief," and widely applied to all the Central Asian tribes of Turkoman blood.

I have used the term "Turkoman" generically to include the Uzbegs. The Chiefs of the Khanats, and the people of the valleys adjoining Affghanistan are Uzbegs, not Turkomans proper.

The Sarts and Tadjiks are now more the subject race in towns and cities than a politically important section of the general population. I gather that most of the rural agriculture of the settled Khanats is in the hands of the Uzbegs.

The plains and oases of Turkistan are more or less, in some sense, divided among the three great Khanats. In the hills north of the Amor are some chiefs, practically quite independent, and the same position is held by the Chiefs settled on the skirts of the Hindoo-Koosh.

Since the Chinese yoke has been thrown off Western Tartary, the oases there are also ruled over by separate Khans.

My object hitherto has been rather to state facts than to enter into political argument, but I would like to be allowed briefly to recapitulate what I may call a few political facts.

First, with respect to Eastern Turkistan. I venture, once for all, very briefly, to assert, that we might put political questions aside altogether, and that merely as a question of plain physical geography, any hostile movement towards India from that quarter is simply impossible; that, in fact, the very idea is utterly absurd and out of the question. I may quote Sir Henry Rawlinson, as a great authority, in that view. That a modern Army should march three or four hundred miles over the highest portions of the globe, over a vast unproductive and almost inaccessible region, ranging from 15,000 to 21,000 feet high (without counting the higher mountains), is a thing not to be thought of till aerial machines are perfected. I dismiss the idea altogether.

Undoubtedly, for the purposes of trade between British India and Eastern Turkistan, it is most desirable that the direct route should, if possible, be opened up, and great credit is due to the Officers who have pushed the matter. The advantages of the route are manifest, both in an immense saving of distance as compared with the route by Cabul and Khokan, and in the fact that the political obstacles to trade, so glaring in the other route, do not exist, if we can only get over the physical difficulties of the road, which are enormous.

I trust that the transit will be accomplished, and that a very beneficial local trade, both in the shawl wool of the high regions, and with the countries beyond, will spring up.

In a political point of view, I should say that so far as our interests are concerned, we might highly applaud the occupation of Eastern Turkistan by the Russians, if they should push on in that direction. It would occupy their hands, and keep them away from us, placing them perfectly safe on the other side of the wall as it were, and all on the way to China, instead of to India. Even their tariffs would hardly treat our trade worse than those of barbarous native princes; and if the road were opened to travellers, it would be a pleasant diversion of the monotony of Indian life to run over and visit Russian settlements in Yarkund and Khoten.

The question of the approach to India by the Caspian and Khorassan has been so fully discussed for the last thirty years, that I shall say little about it. Russia is in that direction no nearer to us than before; and in any question of this kind, the great thing is to keep before us simple figures of distance and height, and to bear in mind relative magnitudes.

Astrabad at the south-east corner of the Caspian, is as nearly as may be, 1,250 miles from the Indus; say from the shore of the Caspian, by Meshed to Herat, 500 miles—Herat to Candahar, 370 miles—Candahar to Shikarpore in Scinde, 378 miles. Short of being absolutely impassable to Armies (like the routes 20,000 feet high), the whole road is one of the most uncomfortable and impracticable in the world, being a succession of deserts and mountain passes—the seats of predatory tribes—with the rare cultivated tracts which you see, hundreds of miles apart. Most of you are better qualified than I am to judge what would be the difficulties of such a march of 1,250 miles—somewhere I suppose about the distance from Paris to St. Petersburgh—ending in by far the most disagreeable and least promising part of India. After all, too, the Caspian is not the ocean with all the resources of ocean steamers; we found it a pretty serious undertaking to land a few thousand men on the coast of Abyssinia; how much more difficult to land and supply a great Army on the southern shore of the Caspian, with only the naval resources of the Caspian.

The routes from the Caspian to the Khanats seem to have been for the present nearly abandoned by the Russians. The lines of wells marked on the maps notwithstanding, there is practically for military purposes a nearly waterless and utterly desert tract of some 500 miles between the Caspian and Khiva, and the latest papers seem to treat the route as impracticable for armies, although there are projects for reviving it, and creating a communication with Georgia and the Caucasus.

We come then to the line of advance by the Syr Darya, by which the Russians have lately pushed forward, and where the present interest of the question lies. It will be seen, that by this route little would be gained on the way to Bokhara and Khokan by using the Sea of Aral. In truth that seems to be a most uncomfortable sea, with utterly desert, shallow and sandy shores, yet stormy, so that shallow river boats cannot venture on it. The great rivers exhausted in their course through the desert, enter it by very shallow channels, giving not more than at most two or three feet of water. Any communications by the Sea of Aral are but supplementary to the land route, which the Russians really use. They have now, I believe, a force of about 13,000 men in all in Turkistan, and the difficulties of getting their troops there, may be judged from the following sentence taken from the official report of General Romanoffski. "*At present it takes two years to march a body of troops from the Volga to Turkistan.*" Only consider that, to say nothing of the route from Turkistan to India!

I would describe the situation somewhat thus:—In the middle of the last century we had not advanced in India beyond the neighbourhood of Calcutta, the Russians had not advanced far beyond Orenburgh and Petropaulosk. Taking the Hindoo-Koosh mountain system as the dividing barrier, Calcutta and Orenburgh are about equidistant from the foot of the mountains on either side, say about 1,400 miles from Calcutta to Peshawur, and the same distance from Orenburgh to Balk and Khulm. We may take India and the countries on the other side to be also, in a rough way, about equal areas. But the difference is, that India is a fertile and well-watered country, inhabited by a race singularly patient of foreign rule, while the other is the most desert country on the earth, inhabited by the most intractable of human creatures. Consequently, it has happened, that in the course of a hundred years, we have occupied the whole of India, and not only occupied it, but established a complete and settled dominion there. We have made a network of railways through our dominions. Already two lines from either coast are all but completed as far as Lahore, a great part of a third line is constructed, and the missing link will probably soon follow; also a fourth line by way of Baroda. The continuation from Lahore to Peshawur is undertaken, engineers and materials have been dispatched. But the Russians contending with much greater difficulties, have in the same period made much slower progress. They have not occupied half of the country which lay before them; only of late years have they established themselves on the upper Syr, and come into collision with the chiefs beyond. Real roads or railways in any part of those regions they have scarcely yet dreamt of. They have but established caravan routes in the Desert, with halting places, along which caravans and small bodies of troops are painfully pushed, in two years' marches, as I have shown. As one swallow does not make a summer, so one successful expedition does not subjugate such a country; we must not jump to that conclusion, even if their troops advance further than they yet have. Supposing that the Russians were fully, firmly, and finally established in the whole country North of the Hindoo-Koosh, we should still be separated by a barrier say six to eight times as great as the Alpine barrier between France and Italy, a succession of mountain ranges more than twice as high, and three or four times as broad. The distance from Balk to Peshawur is 470 miles, the heights to be surmounted upwards of 12,000 feet; that distance over such a country might be enough to keep apart any two peoples, unless they are very desperately anxious to fight.

But this is looking into a far distant future. How long will it take Russia to settle herself in Turkistan? How much will it cost her? Is she able?—is she willing to incur the enormous cost? Supposing that she can, and does do so, the country will not be a second British India, but at best a sort of exaggeration of Algeria, a country infinitely more inaccessible to Russia than is Algeria, lying at the very door of France, many times the size of Algeria, much more desert, inhabited by more savage and untameable races. The thing is not to be done, except at an enormous expense. At present Russia can hardly find money for necessary works; where is she to get it for so vast an undertaking? And is the chance of what may come after, worth such cost to her, if she could get the money? Modern wars against civilized powers are not now conducted by mere hordes rushing down to conquer; every day, war becomes more and more a question of money and material. I take it, that in any view, it is totally impossible that Russia should attempt an invasion of India, till she has settled herself in Turkistan, as we are settled in India; till she has made railways to Bokhara and Balk, as we have to Lahore and Peshawur. If she attempts that, I will give her at a moderate computation fifty years to do it. But what may not happen before it is done? The proper Sclave races may hive off, and Russia be dismembered. We may abandon India, or it may be conquered by the great Australian Empire of the South. If we both subsist as great powers, why then, in the time of our grandchildren, the question may give rise to some diplomacy and anxiety. The Affghans may make a great deal of money out of both powers, putting themselves up to the highest bidder; but after all, there will still be the mountains between, and the power attempting to cross them, will be at an enormous disadvantage.

Take the present situation; it is at least 1,000 miles, as the crow flies, from Orenburgh to Bokhara—by road it must be considerably more—through an unmitigated desert almost the whole way. It is, of course, still farther from the Volga, the real basis of Russian advance. If the Khokan oasis be taken en route the distance will be considerably longer. From Bokhara to Peshawur the distance is 760 miles, and what are the practical difficulties of that route may be judged from the fact that under the most grievous provocation which a great nation could endure, the barbarous imprisonment and murder of our accredited Officers, we were unable to make any attempt to reach the Khan of Bokhara. Thus we have from Orenburgh to Peshawur a distance of at least 1,800 miles, for a practicable route we may say 2,000, or from Russia in Europe 2,500 miles, over horrid deserts, mountain gorges, and passes fully 12,000 feet high. Just realise what a pass of 12,000 feet is. It is all very well to talk of the "Bameean Pass" as practicable for artillery, because on some occasions one or two guns have been dragged across by mere manual labour of thousands of men. Ferrier says that Nader Shah took his artillery over, but the proof of it does not say much for the route, viz., that one of the guns is to be seen there to the present day, stuck on the road! Vambery tells us that for trade, the road is not much used on account of the difficulties of the Hindoo-Koosh. The pass is well called the "Dand skikan"—the "tooth breaker." It is only passable from June to the beginning of November. Consider what would be required to convey a modern park of artillery and all its material over a succession of passes *twice* the height of the Simplon, and for upwards of 400 miles of such roadless ground. Even if it be possible, what would it cost to march an Army from the Volga to Peshawur? What did it cost us with every possible facility and means of sea transport, with no enemy on the route, and a country not half so high and difficult as the Hindoo Koosh, to place some 3,000 men in line at Magdala, something over 300 miles from the sea-coast? How much more would it cost to march a much larger Army so much greater a distance, in so much more difficult a country, held by tribes whose profession is plunder? I do not believe that the thing is to be thought of in our day. Even Orenburgh is not yet connected with Russia proper by a long way.

In truth, the efforts of Russia, the systems of railways on which she is engaged, are not directed to the east but to the south. She is, I believe, not working in the direction of Orenburgh, but is concentrating her strength in the interior, and directing it by lines of rail towards the Black Sea—it may be towards Constantinople. If she has still any such designs it might probably well suit her that we should alarm ourselves about the East. By betraying, as it were, a raw place in that direction, a sensitive place where we can easily be made to wince, we are but playing her game. And still more by the continual repetition of these alarms, we are ourselves creating in the native Indian mind that very belief in Russia which we deprecate.

My object has been, as I have said, to submit broad, simple, and uncontested facts, and I do think that the mere realization of the most prominent facts and figures, the number of miles which divide us from the Russian power, the height of the mountains, the character of the country and people, may well allay alarms, and satisfy us that we may adjourn the Russo-Indian question for the possible consideration of the next generation, or the generation after that.

All this, moreover, is on the supposition of possible unfriendly designs on the part of Russia. It is well to take into account the most unfavourable contingency, but I had very great pleasure in listening to the important communication made the other day by Sir Roderick Murchison, in this theatre, that the Emperor had pledged himself to harbour no designs against our eastern possessions, and not to interfere in the politics of Affghanistan. I admire the friendliness of that declaration, and I also admire its good sense, for I am sure that nothing will be so beneficial both to the Russians and to ourselves as a good understanding, which will obviate the chance of both being victimized and bled by the Affghans, and prevent the abuse, by the disaffected on either side, of rumours regarding the proceedings and projects of the other. Especially must we be careful of receiving stories of Russian proceedings from the Affghans, the very people whose interest it is to magnify everything of the kind; and it is because all our Indian news of Central Asia comes through this channel that it is little to be relied on.

It would not be desirable that I should say much of our relations with the Ameer Sher Allee, of which we have no complete knowledge. I do not doubt that the Ameer is a very excellent Affghan chief, and very worthy of our friendship. As respects, however, any great degree of intimacy with him, the extreme instability of everything in Affghan politics must always be borne in mind, and this, too, which I have explained, that the Ameer's dominions really scarcely march with ours at all: he is merely a power near but not adjoining us, with whom we may well cultivate a friendly commerce and acquaintance. In my view, to send a European agent to Cabul would be undesirable for two reasons; first, that his life would not be safe, and we might by the act of some discontented individual become involved in a hostility especially to be deprecated; and, second, that if the thing went on smoothly it would still be putting our head into the lion's mouth; our agent would be considered by every chief in Central

Asia fair game to squeeze for money, and all who did not get it, would be aggrieved and disgusted.

My idea would rather be, that from our own borders we should cultivate general relations of friendliness; that we should make it thoroughly apparent that beyond those borders no one has reason to fear our aggression or interference; and above all things, that we should convince the Mahommedans of our own districts, by our practice and our manners, that we have no other desire than to cherish them as good subjects of the Crown, and that we shall never permit that political or religious prejudice against them should in the slightest degree actuate or colour our conduct.

The Chairman: After the very interesting paper which you have heard read, probably some gentlemen may be desirous of offering observations or of addressing questions to Mr. Campbell. As time presses, I must request any gentleman who may rise to condense his observations as much as possible. I say these few words in order to invite discussion. I see a gentleman present who has an extensive acquaintance with the subject, the meeting would be very desirous of hearing any observations he may think it desirable to offer, Sir Charles Wingfield?

Sir Charles Wingfield, M.P.: I really do not think I can enlighten the meeting at all, and what I have to say on the question I had better, probably, reserve for a future occasion, when the question may come before Parliament. Unfortunately I have not heard the whole of Mr. Campbell's paper, as I have only just come into the room. There is one point, however, upon which I should like to get the opinion of people who are much better informed than myself. Without apprehending any acts of hostility on the part of Russia, suppose that a demonstration should be made against British India, I should like to have the opinion of people more conversant with military matters than myself, what would be our strongest line of defence; whether we should confine ourselves to occupying the mouths of the passes on our side of the mountains, or should we cross the mountains and occupy the entrance of the passes on the side of Affghanistan?

General Sir Vincent Eyre, K.C.S.I.: I am not prepared to enter fully into the question raised by Sir Charles Wingfield, but looking at that map I cannot help thinking that the view taken by Count Nesselrode was a very accurate one; that it is a very ugly looking map, that the country which is there represented, and still more as it really exists, is a very formidable barrier between India and Turkistan, and that the Emperor of Russia is a very wise man in what he has recently stated as his intended pacific policy. I do not believe that any wise man, placed as the Emperor of Russia is, with very great responsibilities, looking at that map, and still more looking at that country as I have seen a great portion of it, would undertake to hurl an Army against such a force as exists to meet him in British India. With regard to the points mooted by Sir Charles Wingfield, I think there can be no question that, although, no doubt, we have a very strong barrier in the river Indus itself, with the means which we can bring to bear to strengthen it in the weakest points, it would, nevertheless, be the duty of any British General commanding the frontier, to occupy the passes beyond. I believe those passes to be exceedingly strong and defensible with comparatively small bodies of men. I hope that the negotiations which have recently taken place with the Ameer of Cabul may facilitate the placing of those passes more at our disposal in the hour of need. I am not aware to what extent these negotiations have been carried on. As it has been stated by Mr. Campbell in his able lecture, we know that the tribes inhabiting those passes are in a very great measure independent of the Ameer of Cabul, to such an extent that it was stated lately that on his visit to our territory he was obliged to pay black mail himself in order to get through the Khyber Pass. I believe the chiefs and tribes of those passes are quite open to negotiations, and there would be no difficulty whatever, if ever such a crisis arrived, in our obtaining a sufficient hold of them to oppose an efficient barrier to any force that might attack us.

Mr. Wyllie: I desire very cordially to concur in the remarks which have fallen from Mr. Campbell, as to the want of credibility which attaches to statements coming to us from India with reference to the progress of Russia. They are, as Mr. Campbell says, entirely derived from Affghan sources, and Affghans, as Mr. Campbell says, have an obvious interest in making the advance of Russia as formidable in our eyes as they can. There is another point which Mr. Campbell brought forward, I think very well, namely, the parallel which he drew between Scotland in former days, and Affghanistan up to a recent date, and even up to the present time. The country contains a variety of independent tribes, and the head of the principal tribe holds a very loose and undefined sway over even his own tribe, and to a still greater degree are the other tribes independent of his control. On the other hand I may mention a matter to which I think Mr. Campbell might perhaps have accorded more prominent mention, that is, the politicians who do enlarge upon the dangers to our Indian empire by Russian progress, speak of the advance by Herat through Persian territory, and of the great danger that might accrue to us from any offensive alliance between Russia and Persia. I should have been glad, therefore, to have heard Mr. Campbell ventilate the arguments connected with the Persian route. Indeed, as regards the other routes referred to by Mr. Campbell, it is generally acknowledged that any military movement by way of Balkh, Bameean, and Cabul, could only be of effect if conducted in concert with greater operations from Persia and the Caspian through Herat; and Sir Henry Rawlinson, from whose lips every word is of the utmost importance, has long ago dissipated any fear of danger to us, however small or remote, by way of Changchenmo or any other pass from Eastern Turkistan. Lastly, Mr. Campbell appears to me to take too seriously the declaration made by Sir Roderick Murchison the other day as to the pacific intentions of the Emperor of Russia. I doubt very much, indeed, whether the Emperor of Russia is in a better position than ourselves to forswear for ever, under all possible circumstances, any attempt to interfere with the independence of Affghanistan. It is very courteous and diplomatic language on the part of the Emperor of Russia. I am very glad to hear it, and I do not at all question its sincerity, but it is a declaration to which I can not, for practical purposes, attach the slightest value.

Mr. Riddell: I do not think those who fear a direct attack on India by Russia have any sound reason for their alarm, but those who have lived in India, especially those who have travelled over the length and breadth of the country, as I have often done, must be fully aware that there is a general feeling of uncertainty prevailing among the native population as to the permanence of our rule in India. Any attack by Russia or Persia, or any other nation, I will not say Russia, because I do not believe that Russia would attempt anything of the kind, or if she did, that we should be beaten by her, but any nation that seriously threatened us upon our northern or western frontier, would excite in India a state of feeling which would cost us many millions to repress, and which it is well worth our while to spend hundreds of thousands of pounds to prevent. Therefore, I think the Government have very wisely, at this moment, determined to subsidize, or if subsidize is a phrase which one ought not to use, to induce the Ameer of Cabul to be our friend, and to listen rather to our blandishments than to those which may be used by powers more to the west. With respect to the question, whether an invading Army, if it is not resisted by us, could penetrate through the Suliman range, and through those ranges which border our frontier on the west from Peshawur to Scinde, I think those who know those parts, and who have questioned merchants who annually traverse the passes, can have no doubt whatever that unless we are prepared to resist it on the western side of the Suliman range, an Army could debouch on the plains of India, and be ready to attack us on our frontier there, and certainly with more chances of success than if we held the passes and crest of the Suliman range. Never having been there, I cannot pretend to speak from personal knowledge, but from information which I have acquired from merchants, I believe I may say that between Peshawur and Shikapore, there is not forty miles of our frontier which could not be penetrated with perfect ease by an Army with guns, with the whole of its ammunition, with its whole force, provided there was no opposition in the mountains themselves. The question then is, is it cheaper and better for us to make friends with the tribes on the west, than to remain sulkily and sullenly within our own boundaries, and say to the tribes who are semi-independent, "Do as you please, we will not assist you, we will not help you. If an enemy comes you may assist him, but we in the meantime during peace will not assist you." That appears to me the question of the present day; that is the main question. As to whether Russia will come, or Persia will come, or whether Affghans will come, that is a question that I do not pretend to enter into, and I hope it is one that within our generation we shall not need to discuss.

The **Chairman**: Probably, before Mr. Campbell replies to any of the observations that have been made, it may be convenient that I should briefly state my own views upon the subject. In making that proposition, however, I would beg it to be understood that I do not speak in any official capacity whatever; I speak simply as an observer like any other gentleman who may be present at this meeting, and I think there are certain grounds which really entitle me to give an opinion, for it so happens that it is now thirty-five years since I first went into the public service in Persia, and that from that time to the present I have been continuously engaged in studying, and occasionally in directing, our relations with the nations of Central Asia, so that, as far as experience goes, I may be permitted to speak with some authority, at the same time, of course, I may be liable to error like any other gentleman. Now, with these few words of preface, I would just ask the meeting to consider what the real question before it is; I mean the political question, for that is the most interesting point for the public, not that I at all undervalue the geographical and ethnographical portions of Mr. Campbell's paper, they are all of first rate importance. But the particular question which, undoubtedly, at the present time most engages public attention is, how far there is any real danger to India from the position and movements of Russia in the east, and if there is any such danger, how it may best be met. On this point, then, I say frankly that I do not believe there is any *real* danger at all. When I say *real* danger, I mean danger of actual invasion. If the public understood what the present position of Russia in Turkistan was, or what it may be in the future, I think that very much of the present feeling of apprehension would be dissipated. But, unfortunately, great ignorance prevails upon these subjects. The general notion is that Russia has overrun all Turkistan, and annexed it, has, in fact, conquered the whole country, and has thus become almost a neighbour to us in India. But such is not by any means the case, all that Russia has really done up to the present time is to conquer and annex the country as far as the Jaxartes. That projecting line which you see marked on the map by a thread, stretching from the Jaxartes beyond Samarcand, is not a conquest, it is a mere cordon of military posts. Russia has not, in fact, annexed any portion of the country on this side of the Jaxartes. Although she occupies Ura-tepeh, Jezzak, Samarcand, and Katta-Kurgan, it is merely as a military cordon, established for a specific purpose. This advanced movement, indeed, was suggested by one of her Generals, for the purpose of what we call, in nautical phrase, "breaking the line." The object, as Romanoski distinctly says, of pushing on to Samarcand, was to divide the territories of Kokand from those of Bokhara, and to press equally upon both. Although, indeed, she has thus run a line of military posts as far as Katta-Kurgan, she has not annexed any part of the country south of the Jaxartes, that is, she does not collect the revenues, nor does she exercise jurisdiction. There are, in fact, no Russian courts, or any of the machinery of government such as is in full work on the northern side of the Jaxartes. Let us consider, too, what she proposes to do in the future, what is the political position at which she aims? She intends avowedly, sooner or later, to bring the Khanates as much under her control as possible. But she never meditates conquest or occupation in the wholesale way in which we have conquered and occupied India. She is perfectly aware that such an entire supercession of native power is beyond her means. To occupy and annex the three Khanates, to incorporate them in her dominions, to collect the revenues, to bring the Russian laws into play throughout the country, would require probably an Army of 100,000 men, and for such a gigantic task she is not prepared. All that she proposes, then, to do, is to exert a strong influence over the country, to maintain a military occupation at certain points, but to keep the native governors generally in power, and through them to exercise a full political control over the inhabitants. Now that is precisely the position in which we were placed during our occupation of Affghanistan in 1839–42. It is a false position for any European nation to occupy in Asia, and it would be for Russia in Turkistan a still more precarious position than it was for us in Affghanistan, inasmuch as she would be much further from her supports, and would be without any party in the country to befriend her, such as we had in Affghanistan. Therefore, if she realizes what her own Officers say she aims at, she will be in a position in which we shall have much more power to injure her than she will have to injure us. That is the great truth which I am anxious to point out. Instead, then, of our having to apply to her for forbearance, the more natural course would be for her to apply to us for forbearance. So long as affairs remain in the position I have indicated, it is quite absurd to talk of danger to India from an invasion by Russia. All that she could ever possibly do would be to intrigue with the Affghans, and through them to create disorder on our frontiers. But if she attempts anything of that kind we have the means of retaliating. I am, of course, putting an extreme case. At present we know that Russia has no intention of the sort, and it is very unlikely that she will ever have any such intention. It is true that in the semi-official Russian papers allusion is made to the possibility at some future time of a Russian demonstration against India. It is argued, indeed, by Russian politicians as one of the most valuable results of their present movements in Central Asia, that in the event of any complications in Europe, Russia will be in a far stronger position as regards England than she was at the time of the Crimean war, and who will gainsay this argument? It is a self-evident truth, and if Russia did not avow the feeling we should all equally know that it existed. But it is equally possible that she may exaggerate the value of her present improved position. I do not myself think that that position, regarded as a better means of injuring us, is really of any great importance. At any rate, if we keep up friendly relations both with Persia and Cabul, it seems to me that Russia is nearly powerless to harm us. I lay great stress at the same time upon those two points, and it is in that view that I think we have acted most judiciously, I will not say in subsidizing, because we have not subsidized, but in establishing friendly relations by means of a liberal pecuniary assistance with the Ameer of Cabul, and I further think we should equally be acting judiciously in exerting ourselves, as was suggested the other day by Sir Vincent Eyre, in the lecture he delivered in this room, to strengthen our interests in Persia, and to cultivate intimate relations with that power. So long, indeed, as we are really on sincere and cordial terms with our neighbours in Persia and Affghanistan, not only can no invasion or demonstration against India be attempted, but no possible intrigues, if they were attempted, could succeed in raising trouble on the frontiers. There are two further points referring to our relations with Russia which I am desirous of briefly noticing. Firstly, it has been suggested by some of the leading organs of the English press, as well as by others in India, that there should be some specific agreement or convention with Russia for the neutralisation of Affghanistan, and this suggestion seems to have been very favourably received by the public of both countries. The second point refers to the announcement which was made the other day in this room by Sir Roderick Murchison, that the Emperor of Russia had officially declared that Affghanistan was beyond his sphere of action, that under no circumstances would he interfere in any way, politically or otherwise, with the Affghans. Now I must say that if such a communication has been really made, it must be received as a very gratifying mark of the good feeling of a friendly power, but I do not think it can have any practical bearing upon the future treatment of the Central Asian question. I should at any rate feel exactly as comfortable, and probably more independent, if no such assurance had been given. I think we are strong enough in India to look after our own interests. I cannot conceive any necessity for our going to Russia to propose a convention for a delimitation of frontier. I think it would be better that matters should be left to run their course. As I said before, Russia has as much need of forbearance from us as we have from her. At the same time I do ask, what is the use of all these jealousies and recriminations? Surely Asia is quite large enough for both of us. I should say let Russia run her own course in Central Asia without any interference on our part; let her settle and colonize the Khanates. It will take her a long time, it will take her at least a generation before she brings them into any real subjection to her authority. Let her occupy herself with that task, and if she succeeds it will be a great gain in the way of civilization. As philanthropists we must needs wish for her success, and politically I really do not think it matters much one way or the other. In the meantime I think we ought principally to attend to our own duties in Hindostan; and, secondarily, to cultivate friendly relations with our neighbours. Let us conciliate the Affghans by liberal presents of arms and money, for that is the only way effectually to touch them, and having once secured them in our interest, let us maintain them as a sort of "buffer," to prevent a contact with powers beyond them, which might, under certain circumstances, be dangerous. There is one other point which has not been alluded to, but which is nevertheless of some importance at the present crisis, I mean, commercial rivalry. Putting aside all political questions, I still think there will be, as a necessary consequence of the recent movements, considerable commercial rivalry between Russia and England in Central Asia. Russia is exceedingly anxious to bring her own produce and manufactures into that country, and she will thus be naturally disposed to shut out our commerce as much as possible. I need hardly remind the meeting that the doctrine of free trade has not penetrated into Russia. In St. Petersburgh they are still protectionists, and maintain a prohibitive tariff upon our cotton goods up to the present day, and this system will assuredly be extended to all the Russian conquests in Central Asia; but this after all is an evil that will correct itself, because if the Indian trade is found to be lucrative, there will arise an extensive system of smuggling on the Turkistan frontier, which will be most injurious to the exchequer and most damaging to public morality (as has been the case on the Western frontier of Russia). Before concluding, I cannot help saying that I think it is a great pity a discussion of this important subject has not been entered upon in a more public and general way. I regret exceedingly that on two occasions such discussions should have been stopped in Parliament. I still hope, however, the day will come for a full discussion. It seems to me that the more this question is ventilated, and the more the *pros* and *cons* of it are publicly discussed, the more tranquillizing will be the effect both in India and England. In India the public will learn that Russia is not advancing with mighty strides, as we sometimes hear, to swallow us up bodily. They will learn that she is really stationary; that she has no desire to injure us; and that if she had any such desire she has not the power. While we, in England, shall also derive considerable benefit from the discussion. One result will be that we shall see it is not wise to irritate a friendly power by querulous and premature complaints; that it is not wise either to try and bind a giant in the silken cords of diplomacy. What we should do is to pursue our career of good government and improvement in India; to avoid all causes of offence and misunderstanding with our neighbours, while, at the same time, we take all legitimate precautions with the view to strengthen our own position, and are prepared if the occasion should arise to adopt any further measures that may be necessary for the protection of our interests or the vindication of our honour.

MR. CAMPBELL: Gentlemen, I deem it a very great happiness that my feeble efforts to inform you, have been the occasion of bringing out so much more ripe and authoritative an exposition of this subject, from our gallant and learned Chairman, who has just addressed you. I feel that what he has said almost relieves me of the necessity of adding much more upon the subject by way of reply. I am afraid I have detained you a long time. I have beat a long way about the bush, but Sir Henry Rawlinson, as far as the political question is concerned, has stated the very kernel of the matter. He has explained clearly and authoritatively that Russia has not conquered Turkistan, but has only established a chain of military posts in a certain portion of that country. I am proud to have a confirmation of the suggestion that I ventured to throw out, that if Russia should determine to conquer that country it will take her a long generation to do so; also that it will not be profitable to Russia to attempt the conquest of that country; and that the probability is that she will not attempt it. That has been put before you so clearly by Sir Henry Rawlinson, that I think the political part of the argument has been clinched, and made evident to almost every one in this room. I do not think there are many more points on which I need say much. I would rather avoid expressing an opinion with respect to the negotiations with the Ameer Shere Ali. I have no information upon that subject: and I should be sorry, as a servant of the Indian Government, to attempt to express an opinion at present. Therefore, I will only say generally, that I most thoroughly and heartily concur in all that has been said by Sir Henry Rawlinson and other speakers, with regard to the expediency of cultivating friendship with the Ameer of Cabul. I believe it is desirable in every way, whether for Indian interests, or for Affghan interests, or for our policy and commerce in Central Asia, to cultivate friendly relations with the ruler of Cabul. To give him assistance is a different matter. And how far we should assist him or pledge ourselves in any degree as to assistance in any shape in the future is a matter upon which I would rather not express an opinion, because I have not the means of forming an opinion. I should like to say one word, as respects the declaration of intentions and policy of the Emperor of Russia to which allusion has been made, and which Sir Roderick Murchison announced in this room the other day. I think Sir Henry Rawlinson's remarks have so far differed from me on that point, as to lead you to believe that I was wrong in expressing pleasure at that announcement. With every deference, I will say this, that while I thoroughly concur that it would be altogether inexpedient for us to go to the Emperor of Russia and say, "We are excited and annoyed by these rumours of your proceedings, we hope you will tell us that you are not going to injure us," I think, on the other hand, the Emperor of Russia, being a friendly power and having himself an interest in Central Asia, being at least as vulnerable in that quarter as we are, if the Emperor of Russia, as a friendly power in Europe, thinks proper of his own accord to come forward and tell us that we need not disturb ourselves, since he pledges himself not to interfere in Affghan politics, we may very well accept that assurance with the same frankness that he has made it. It is an indication of good will on the part of Russia, which we ought to accept, as tending to a good understanding advantageous both to ourselves and to Russia. As I ventured to say before, if we throw dirt enough, some of it is sure to stick, so if we propound ever so false and ever so unreasonable ideas upon the subject of Russia through the press, it permeates the public mind; and it is, no doubt, the fact that the public mind in this country has been a good deal drawn to this subject. Then, there is another view to be taken. It is said that the native mind in India is disturbed by these reports. I will say at once that if, in any degree, the native mind in India is disturbed on this subject, we owe it entirely to ourselves. I believe nothing has happened in Central Asia, and nothing has come from Affghan sources sufficient seriously to disturb the natives. The natives of India know the Affghans as well as we do, and scarcely believe, and, at all events, do not act upon their stories. I think there is not much importance to be attributed to these stories among the natives, except so far as they are derived from our newspapers. Is it not the fact that our newspapers teem with alarming rumours with respect to Russia? We are told that Russia is here, that Russia is there, that Russia has crossed the Oxus, and so on, as if they were at our doors. These paragraphs appear in our English newspapers. You do not suppose that those paragraphs are not copied into the native newspapers? Of course they are. We do all we can to excite the native mind, and make them believe that we are really apprehensive of the Russians. Therefore, I think if the Emperor of Russia does come forward and say he does not intend to push towards our frontier or to interfere with Affghanistan, if we have the pledge of the Emperor of Russia, who is the responsible head of a great European State, that he will not interfere with Affghanistan, I say it will relieve us of a good deal of trouble, and especially of some of those reports which may affect the native mind. I do not allude to the Persian route, because I feel that that is a subject that has been fully discussed for the last thirty or forty years. The Russians are no nearer to us in that direction than they were; and in the presence of Sir Henry Rawlinson I would not attempt to give an opinion upon that subject.

The CHAIRMAN: Before the meeting breaks up, permit me to express your unanimous thanks to Mr. Campbell for his paper.

Evening Meeting.

Monday, April 19th, 1869.

Major-General F. W. HAMILTON, C.B., Vice-President in the Chair.

NAMES of MEMBERS who joined the Institution between the 14th and 19th April, 1869.

ANNUAL.

Bacon, Francis, Lieut. Roy. Mar. Art. 1*l*.
Rowley, Henry F., Lieut. 78th Highlanders. 1*l*.
Campbell and Stratheden, Right Hon. W. F. Bacon, Major 46th Middlesex Rifle Vols. 1*l*.

A PROPOSITION FOR ONE GENERAL MILITARY SCHOOL FOR THE ARMY.

A paper by Colonel T. Bernard Collinson, R.E.,

and read by the Secretary.

The Chairman: The Secretary will now read a paper by Colonel Bernard Collinson, of the Royal Engineers, who is at present at Malta. I regret that in consequence of that circumstance he will be unable to read the paper himself. After it has been read I shall invite discussion on it, and I have no doubt that some gentlemen present will offer some observations and open the way for the discussion of a subject so interesting to the future of the Army.

The Secretary: The appointment of a Commission to inquire into the system of Education of Candidates for Commissions in the Army offers a legitimate opening for the discussion of the subject in general, and one which the Royal United Service Institution can fill with great propriety, and no doubt with benefit to the labours of the Commissioners.

The following propositions on the subject will serve at least as a basis for the discussion; they are the results of personal experience in the education of young Officers. In taking up such a subject, it seemed to me desirable to begin from the foundation of the qualities required in an Officer; but it is done in a rude, imperfect manner, for it properly involves questions too intricate and extensive for me to deal with, or for such a paper as this. In attempting it, I have endeavoured to classify the branches of the Army without any predisposition to overrate the importance of any one part of a service, the efficiency of which, though depending in a great measure on the mutual co-operation of all branches, is really based on qualities beyond the reach of any scheme of public education.

1. The qualities one would desire to see in young men seeking to be Officers in the Army may be classified in three great divisions; 1st, *Physical Strength;* 2nd, *Imagination;* 3rd, *Reasoning Power.* These three great branches of human faculty may, in their various ramifications be considered to comprise every quality, and practically to embrace every branch of knowledge that an Officer in the Army should possess: it is the comparative extent of each only that requires to be varied for the different branches of the Army. But if we assume that the following qualities are comprehended under each head, then every Officer in every branch of the Army requires a certain amount of each.

1st. *Physical Strength.*—Under this head would be included skill and activity in all kinds of sports and exercises, as well as a certain amount of bodily health and strength; without this no body of Officers, however talented or able, or otherwise powerful, would be efficient for active campaigning. With it, and with habits of discipline, as long as there are some able men to guide the Army, talent and learning are not of so great importance to the body of the Officers.

2nd. *Imagination,* or the faculty of readily taking in ideas, and of perceiving and retaining, and to a certain extent arranging impressions of things; being quick-witted and ready of resource; the quality which makes a man quick to learn practical things, and to invent practical remedies in difficulties. It is not easy to test the qualification of any person in this faculty. Those who have it, are generally artists of some kind, or linguists, or experimental philosophers; and the presence of these gifts affords an index of the probable existence of the quality. It is one of great value in Officers, and has been a chief ingredient in the character of many great soldiers.

3rd. *Reasoning Power*; or the capability of induction; of comparing and deducing conclusions from facts and circumstances, and judging of the future results of them.

This is a faculty which, though not always nor fully appertaining to men of mathematical quality of mind, is generally more or less connected with that quality, so that its presence can be taken to a great extent, as an indication of reasoning power in general.

Though an essential quality in great leaders of armies, and in some branches of the Army, it is not so with Officers of an army generally, as compared with the two other qualities.

2. It is of course necessary that Officers in the Army should also possess some knowledge of certain branches of learning and arts; and the tests necessary for ascertaining the required qualifications in these subjects, will be also available for testing the presence of the required amount of each of these three faculties above-mentioned. For instance, it is advantageous that Officers generally should be acquainted with modern languages and history, and should also be able to draw correctly plans and views of countries: the tests for these subjects will

help to show the amount of imagination they possess. And the tests for ascertaining their mathematical and classical knowledge, of both of which Officers should possess some amount, will also test their reasoning capability.

3. The Officers in the different branches of the Army, that is to say Infantry, Cavalry, Artillery, Engineers, and Staff, will require to possess these qualities in different proportions.

For the Infantry Officer, physical power and readiness of resource, are of more importance than reasoning power. Cavalry Officers would require the same qualities in the same proportions, but in a higher degree: because they have the additional duty of the care of animals, and their work extends over a greater field, both in space and kind. Artillery Officers have not only the charge of animals and machines, but work extending over a greater field than Cavalry or Infantry, and which requires a greater knowledge of physical science. For them, therefore, reasoning power is of greater importance, and all the qualities are required in a higher degree. Engineer officers have comparatively small charge of men, animals, or machines; their work lies chiefly in dealing with everything relating to physical science, and to mechanical construction in an army, which necessitates greater reasoning power; at the same time from their being constantly required to exercise their knowledge under divergent difficulties, they also require a fair amount of the imaginative quality. The Officers of the General Staff of the Army require a large amount of physical strength from the constant demand on their activity; and a large amount of imaginative power, as their duty mainly consists in collecting and collating information for the Commanders; but as they are not required to form conclusions on the information, they do not require so great an amount of reasoning power.

4. The next question is, what is the best mode of obtaining these different classes of Officers for the Army; whether by single examination from the ordinary schools of the country direct, or by special education in a separate school?

As regards the Officers for the Infantry and Cavalry there is little difficulty. The education in the public schools of the country is amply sufficient to insure every qualification in the way of the knowledge they require, and affords the best means of testing the amount of the three above-mentioned faculties they possess. Such technical knowledge and training as they require can be given them in their regiments after joining, better than in any special school. Their qualifications can be perfectly well tested by a single examination when they come to the age for entering the Army, direct from the ordinary schools of the country. There are some great advantages in this system, which is that now in practice for obtaining the greatest part of the Officers of the Army. The young men are not removed from the ordinary course of the education of the country before the time for their trial; they remain to the last moment subject to the influence of the public schools, or such teaching as their own friends select, and if at a public school, there could hardly be desired a better training for the Army; it is much better than that of any possible special army school. Indeed special schools are to be avoided as much as possible; they inevitably tend to hand down from generation to generation a narrow system and fixed ideas, in which all the Officers there educated grow up. If they are self-supporting, they will be too expensive for a large class of persons whose children are otherwise very suitable candidates for the Army; and if not self-supporting, they will entail a public expenditure extravagant for the object.

5. In some cases special schools are absolutely necessary, as we shall presently have to consider; and when they are necessary it seems equally so,—as we shall consider hereafter,—that the candidates should be taken at a much earlier age than that at which they would get their commissions under the direct system, so much sooner, therefore, from the ordinary schools of the country.

6. The mode in which the existing system of direct examinations is carried on, has considerable disadvantages, the chief of which is, that it encourages and almost necessitates some months' special training under those private tutors who have sprung into so flourishing an existence since competitive examinations began, and who feed the head at the expense of the body, spirit, and understanding. These disadvantages might be avoided, either by so arranging the test examination as to be more in accord with the ordinary education in the public schools, so that there would be scarcely any difference between them and the extrance examinations to other institutions; or, by placing a certain number of commissions at the disposal of certain schools under proper restrictions. This latter plan, which was once tried with success for Woolwich Academy, is now in disfavour, in consequence of the abolition of somewhat similar conditions existing between some public schools and colleges; those, however, whatever their merits or demerits, would be very different from such as would exist between public schools and the totally independent War Office.

7. But the Officers of artillery, engineers, and staff, require a greater amount of special training. Coming to the profession with higher qualifications in the imagination and reasoning faculties, they have to learn something of the theory and practice of their profession, which they cannot well do after joining for service. They have to learn gunnery, fortification, surveying, military history, and the application of mechanics to their special duties. A special school is necessary for these objects, just as special schools are necessary for teaching the theory of other professions.

8. The candidates for these three branches can be efficiently taught in the same school. The qualifications for entrance are of the same character, different only in degree, and the course of special education is nearly the same. There would be no greater difference between the candidates at entrance than now exists between the highest and lowest successful candidates for the artillery and engineer school at Woolwich; the highest unsuccessful candidates for which school frequently enter the Military College at Sandhurst, and there can be little doubt but that the highest successful candidates for Sandhurst could get into Woolwich. The course of education in the school would have to

be somewhat varied for the candidates for each of the three branches, as is done in many schools.

9. Assuming that it is practicable to combine them in one school, there are many advantages in having only one such institution for the Army. Up to a certain size (the maximum may probably be placed at 400 scholars) one school is more efficient, as well as more economical than the same number of scholars divided. The number itself is a means of training, a larger world of discipline. A higher class of masters can be employed, and being in greater number together, can assist each other more. The educational appliances can be on a better scale, and also the arrangements for board and lodging. The greater number of candidates affords a greater choice for all branches, and the greater number in the school gives each branch a greater choice. The greater the school the less tendency to narrow and fixed ideas, especially when several branches are combined.

10. The age at which scholars should be admitted to such a school is one of the most serious parts of the whole question. To take them a year sooner than necessary from the ordinary schools to begin a special limited course, would lose much of the good of those schools; but the course of subjects above enumerated as requisite for those three branches could not be satisfactorily taught under two years, and to keep young men at school beyond the ordinary age at which the majority of Officers get their commissions, would give the latter an unfair start in life, and make the school unpopular. But the most serious point is the discipline. The difficulties that have arisen at Woolwich and Sandhurst of late years in this matter have their origin, I believe, in the impossibility of forcing young Englishmen of the age at which they enter the universities, to begin to go through the discipline absolutely necessary for Officers in the Army. Those who get direct commissions are subjected to it by being mixed with a larger body of older Officers, who have the habits of discipline, and whose business it is to carry on duties necessitating strict obedience.

11. A body of young men living together at the age at which their fellows at the universities or in life are accustomed to have a certain liberty, will not submit to the precise regulations on all the minor affairs of life, the practice of which altogether makes up the habit of discipline. Discipline is a habit much more than a reasonable conclusion, and like all other habits it cannot be commenced too early; but it is absolutely necessary to begin before a young man commences to form his own judgment, not because his judgment would necessarily go against the discipline, but because from the nature of it he demands greater freedom.

12. There is a certain discipline at the universities, but it is very different from the precise regulations for time, place, and circumstances in military life; a young man goes to the university to learn to think, but he goes to a military school very much to learn to obey without thinking; and it is unnecessary in universities open to all professions and to all the world, to practise such strict discipline of body, because the very fact of the young man's prospects in life depending on the use he makes of the university, should induce sufficient discipline. But

in educating for a profession of which discipline of body forms an essential part, it would be unjust to the country not to enforce its practice specially. The above consideration would, I think, necessitate that the age for admission to such a school should be at least two years before that at which direct commissions are given.

13. Assuming the age for entrance to the military school to be about 15, the next question concerns the tests for entrance, and the course of study in the school.

It is, I think, a very important point that the subjects for the entrance examination should be few. The Reports of the Public Schools Commission, and the results of the examinations at Woolwich and Sandhurst, all seem to me to prove that it is impossible to educate a boy properly in more than two or three subjects. When it is attempted to teach a boy more than that number, it is not education but mere superficial book knowledge, which fills his head to repletion, and strains his intellect beyond its natural powers in the attempt to take it all in. The consequence is, that when he gets his commission, at the age at which he ought to begin to educate himself, his educational forces are worn out, and a reaction against all kinds of study takes place.

14. Now, it is very necessary that every candidate for the military service should, at fifteen years old, possess a good knowledge of simple *Mathematics*, of *Geography*, and of the elements of *Natural Philosophy*; a certain portion of these should, therefore, be compulsory in the entrance examination. The mathematics, which should include the elements of algebra and geometry, is the only one of the three which would require a real education; the other two would be merely the grammars of subjects to be subsequently studied, and would be learnt almost by rote. In addition to these three compulsory subjects, one, and one only, of either of the following subjects might be taken up, according to the education and faculties of the candidate:—

Classics; because it appears probable that they will continue to form the chief subject of the education of young men in England, and because they are good for indicating the presence of both the imagination and the reasoning faculties.

Mathematics, including algebra and geometry; because it is a subject indispensable to two of the branches of the school, and indicates the reasoning power.

Modern Languages; because they are valuable to all branches, and indicate the imaginative qualities. But only one language should be taken up, and that should be studied like the classics, thoroughly, and in connection with history.

The entrance examination, though confined to a small range, should be searching; its object being not to ensure extent of knowledge, but to ascertain that the candidate has been well grounded in the elements of education, and that he has the qualities which will enable him to learn the subjects requisite for his military education.

15. It does not seem to me to be necessary to include any branch of drawing in the entrance examination, although it is an indispensable acquirement for a large portion of the scholars. The fact of its forming a considerable part of the course of the school will be sufficient to

induce those who have the gift, to cultivate it, and any further encouragement would make them neglect some more important study to obtain a little extra skill in this.

16. Before any candidate is examined in his mental qualifications he should be examined in his physical powers. For this object certain physiological standards would have to be very carefully determined, and every candidate should be required, by means of some practical experiments, to prove his qualifications in these standards. Up to a certain point these should be compulsory on all candidates; but it would be desirable to encourage simple gymnastic exercises beyond the average standards, in order to induce public and private schools to practise a systematic course of them. But not much beyond the average, otherwise there would be danger that the natural tendency of English boys towards these exercises would be encouraged to strain their powers too much at so early an age.

17. Similar physical tests should form part of the examination of all candidates for direct commissions in the Army. But the ages of the candidates being greater, the compulsory tests may be higher, and greater encouragement should be given to extra exercises, by giving higher values to the credits for them, which credits should be allowed to count towards determining their places in the examination list.

18. The course of education in the school should include the following subjects:—

1. *Mathematics.*—This should form the leading branch of the education, because it is the one that brings out the exercise of the highest faculties, and is an essential foundation for the study of nearly all the other subjects in all three departments of the school. The complete course of mathematics should include mechanics and all branches of natural philosophy.
2. *Surveying.*—This is the subject of next importance after mathematics in the military school, because it is a most desirable, if not necessary acquirement for Officers of all three branches; and some knowledge of it is indispensable to the study of some of the other subjects. The full course should include drawing, both artistic and geometrical, the representation of ground in plans, the use of surveying instruments, and the theory of astronomy and geodesy; but very little practical surveying should be practised in this school.
3. *Modern Languages.*—I place this subject next in importance, because it requires more study than the subsequent subjects, and is one that can be more efficiently studied at this age. One language only should be taken up at once, and that should be fully studied in connection with the history of the country. Professors of modern languages should not be mere teachers of colloquial phrases, but of the science of the language and of the history of its country.
4. *Fortification.*—This should, of course, form a special subject of study to those who wish to go into the engineer branch; but some knowledge of it is necessary to all three branches. It should include the theory of the construction, and attack, and

defence of fortresses. A little practical acquaintance with field fortification is necessary, but only just sufficient to enable the pupils to understand the details of the attack.

5. *Gunnery.*—This subject would be specially studied by those intended for the Artillery branch; but all three should have some acquaintance with it. It should include, mechanics applied to the construction and use of fire-arms of all kinds, and of the machines connected with them; the chemistry of all kinds of explosive compositions. The practical exercise of guns and machines would be more properly included under the head of drill.
6. *Military History.*—This subject would be important chiefly to those intended for the staff, but is, of course, a very desirable one for all branches. The course should include the general military history of all countries, and the theory of tactics, and of the constitution of armies, but not the strategy of campaigns and battles in detail. A boy of sixteen can learn something about the movement of troops, but it would be waste of time for him to attempt to study strategy.

19. In each of these six subjects there should be a maximum and a minimum course; and at the commencement of each term, each scholar should be obliged to select the subjects and courses he wishes to take up during that term, so as to enable those, who wish to prepare themselves specially for either of the three branches, to study the subjects desirable for those branches. The absolute selection, however, of the scholars for each of the branches need not be made until the final examination. From the results of that examination, the best scholars in mathematics should be appointed to the engineers, the best scholars in gunnery to the artillery, and the best in the three subjects together of military history, surveying, and languages, should receive commissions in the line, and be recorded as qualified to enter the Staff College. There should be, of course, a minimum qualification in each subject, and those who failed to reach that minimum, or who, for any other reasons, could not be provided for in any of the above three ways, should receive also free commissions in the line, but without being considered qualified for the Staff College.

20. The physical education of the scholars should be very carefully attended to during their stay at the school; and its chief aim should be, not to make them skilful in military exercises, but to develop to the utmost their natural strength and health. Keeping this result in view, they should be practised in the use of military weapons of all kinds, and in the drill of all branches of the Army, but not in more drill than is necessary for discipline and health. A certain amount of gun drill and artillery exercises should be practised, and riding and cavalry exercises, and they should be instructed in the management of horses. Simple gymnastics of all kinds should be regularly practised. In order to encourage and methodize such exercises, it should be treated as one of the regular branches of education; there should be an examination in it, and the credits so obtained should count towards determining places for the Artillery and Staff.

21. The administration of such a school is a subject in which I think

an alteration is desirable from the present system in both our military schools. In both, the Officers who have charge of the discipline, are a separate body from the professors and masters. The latter have very little to do with the discipline of the scholars, even when in study, and nothing at all when out of study. The former are only concerned with their outward behaviour as young soldiers, and not with their mental or moral discipline. It is this division of responsibilities which constitutes the difference in this respect between a public school and a military school. I do not think it is indispensable in the latter: the majority of the subjects of education are such as Officers in the Army can make themselves efficient masters in, and I would make the military masters also the Officers of discipline. I would select one of them and make him, with a suitable Army rank, the Commandant of the school, with powers and duties similar to those of the head master of a public school. He would generally, but not necessarily, be selected from the masters in mathematics, surveying, or military history, probably from the two latter, as the head master in mathematics would generally be a civilian. A certain number of the next senior military masters should be appointed the Captains of the Companies of Cadets, and each should exercise a general supervision over the education and conduct of all the cadets in his company. And I see no reason why a similar practice to that which prevails in our public schools, and which is so conducive to the influence of masters over boys, should not be adopted in our military schools, namely, that the cadets of one company should take breakfast and supper together in company with their captain, and that the whole of the military masters and the whole of the cadets should dine together in one room every day.

22. It is hardly within the province of such a paper as this to discuss with whom the general control and government of the military schools should rest. The only point about it which I consider very important as connected with the detail of the working of the school is, that the Commandant, such as I have above described, to whomsoever he may be responsible, should be solely and wholly responsible for the efficient working of all branches of the discipline, education, and recreation of the school.

23. The education of the Officers of the three branches of the Army above mentioned cannot, however, be considered as concluded on their passing satisfactorily through such a school. They have each a good deal still to learn of the technical parts of their respective branches, and which in their particular cases cannot be satisfactorily taught, except at some central establishments. The Staff Officer has to practise surveying, perfect himself in the drill of the various branches, and study the details connected with the art of war. The Artillery Officer has to practise gunnery, and the manufacture of explosive compounds, and artillery exercises. The Engineer has to practise surveying, construction, field operations, bridge-making, and the various semi-scientific duties that fall to his lot. It is hardly necessary to go into any detail on the subject of this subsequent practical education, because establishments already exist for all three branches for this

purpose, and all in very efficient condition, and quite available for the altered system of primary education I have recommended. After being appointed to their respective corps, the Engineer Officers would go to the Engineer School at Chatham, the Artillery Officers to the Artillery School at Woolwich, and those qualified for the Staff College, after serving some time in their regiments, should be sent to the Staff College at Sandhurst without further examination.

24. I will conclude with a word about the site desirable for such a military school as I have been describing. I think it very important that it should be at a good distance from any large town, and in a healthy district, with a good extent of open country about it, and yet, if possible, sufficiently near some large military station to allow the cadets to witness military operations without mixing habitually with the garrison. These considerations would point out Sandhurst to be infinitely preferable to Woolwich for the site of such a school.

The CHAIRMAN: If any gentleman will favour the meeting with any remarks upon the paper, I am sure they will be received with great pleasure. With regard to military history, that is one of the subjects which ought to be carefully studied in all military schools. We have gentlemen present who are quite capable of speaking upon that part of the question. Perhaps Sir Edward Cust will favour the meeting with his views upon the subject.

General The Hon. Sir EDWARD CUST, G.C.L.: I understand that many Officers have not attended here to-day because they do not agree with the sentiments expressed in the paper. I am one of those who do not exactly agree with the whole of the paper; nor do I believe that anybody would agree with all that they hear in this theatre. Yet Officers should come here to listen, to be informed, and to discuss. It is rather unfortunate that any kind of unfavourable impression should be previously taken of a paper that is about to be read here, and I trust that I have been misinformed in the matter. For myself, I desire to call attention to the first paragraph of the paper:—"The appointment of a Commission to inquire into the system of education of candidates for commissions into the Army offers a legitimate opening for the discussion of the subject in general, and one which the Royal United Service Institution can fill with great propriety, and no doubt with benefit to the labours of the Commissioners." Now, that is the point which has induced me to come here; but so far am I from agreeing with the proof of the intended paper that has been circulated, that I disagree from first to last with the proposal for "One general military school for the Army" to an extent, indeed, that some gentlemen may not be disposed to go along with me, but which I am anxious, if I possibly can, to get fairly considered by the profession. I start with this objection, that a special Government school of any sort or kind for so-called "cadets," prior to entrance into the Army, is a mistake. We do not find in any other profession—the church, the law, or medicine, or any other civil calling—that it is considered necessary there should be special instruction before-hand given to aspirants before they have been inducted into it. A general course of instruction is of course open to everybody, and students can select those studies which suit their disposition or their inclination, or the examinations through which they will have to pass; therefore I do not see why there should be any difference in this respect with regard to admission into the Army. No doubt there is a portion of the Army which is highly scientific, and it may be a reasonable question whether the class of Officers that enters it may not require some particular course of previous instruction; but even as a preparation for Engineers or Artillery, it is scarcely more than mechanics and chemistry, that is in excess of education for the Line. The only class that seems to me to require a particular course of instruction before admission into the service of the country is that of the Officers of the Navy. There are such intricate and elaborate matters connected with the Navy, such as ship-building, ship-navigating, and ship-fighting, that it is hardly possible to suppose there can exist any class of men in the community who would be capable of at once entering into the Queen's service in the Navy without a course of education peculiarly adapted to that profession. But what strikes me as extraordinary with regard to the stipulated education of the Army is this, that whilst the most arduous, the most elaborate, and the most trying examination is required for cadets about to enter the Service; yet as soon as they have passed this ordeal, and do enter the service, the State seems to wash its hands of them altogether, and never to care one jot whether they retain what they have learned, or whether what they have learned evinces itself in useful results, or can in any way whatever be turned to good account, either for the public benefit or that of themselves. There seems to be an earnest and eager rush to get into the Service, but that position having been once attained with great difficulty, from that moment the whole thing is left to take its chance, and no inquiry whatever is made as to the results. The great mistake, I think, consists in this, that we throw all our attention upon the boy, and none upon the Officer. For my part, I think, instead of being so anxious about the education of the boy, we ought rather to inquire whether any practical good is derived to himself from this exceptional education. From what I have heard, from inquiries amongst Commanding Officers, I do not understand that those boys who come into the Army after undergoing these arduous examinations make, upon the whole, particularly good Officers, or that they are particularly well furnished with the information which good Officers ought to possess. But what I think is the great grievance, and what I am anxious to put prominently forward as the great evil of the present system is this, that from the moment a young man becomes an Officer at a time of life between twenty and thirty years of age, which, as every man knows from experience, is the time when he can acquire most information, from that very moment it is patent to every one that not one single attempt is made to give him professional knowledge beyond drill and the habitual fulfilment of regimental duties in the barrack-yard. I think this is to miss a very great advantage. I do not at all wish to propound any particular system of education, neither do I think that what Colonel Collinson has suggested here would carry out my object. I wish to see every young Officer, before he attains the rank of Captain, tested as to of what his knowledge of his profession consists. I do not know whether any gentleman present may remember the circumstance, but many years ago a Captain Peters established a new system of equitation for the British Cavalry. The riding-house at the Regent's Park barracks was appropriated to the task, and all the Cavalry Officers of the Army were required to go in squads from time to time, according to a roster that was established, in order that every Officer should be instructed in equitation under Captain Peters. I should wish to see a similar principle adopted with reference to that I have above suggested for the education of the subalterns in the Army. I should wish that those subalterns in the Army, who, in their turn of duty with their regiments find themselves in England, should be required, a certain number at a time, to go up for a few months for the purposes of instruction to the Royal Military College at Sandhurst. I do not know precisely the expense of the present maintenance of the Royal Military College; but there are no less than fifteen commissioned Officers and thirty masters and teachers, who constitute its educational staff. Now, I should like to see the junior department put down altogether, as the special school for gentlemen cadets. You see, there would be ample means, as far as the cost is concerned, of carrying out the plan which I am anxious to see adopted, namely, that the building now used for the boys, with a certain number of superior Officers to maintain discipline, and a certain number of professors and teachers, should be set apart for young Officers, who, in whatever numbers at a time might be thought desirable, should go up and take a turn of education during the period that they are subalterns at home. I am aware that a proposition of this kind has more sides than one; for example, that it might not advance materially the education of Officers. I am very well aware that it would not be easy to get young men between the ages of twenty and thirty to pass their time in study at Sandhurst, unless there were some absolute advantages to be obtained by so doing; but I desire it to be made an absolute obligation on the part of the Government that they should do so, with the view of rendering the entire class of Officers more fit for service, and that they might be more fit for other duties of life after they quit the service; to which matter I will return presently. The only course that could be pursued for Officers of this class would be to give them oral instruction. It would be perhaps, impossible to get them to sit down to pen and paper and study mathematics, or subjects of that nature. My idea is that their instruction should be limited to very few subjects, such as military history, military drawing, military geography, and the principles of attack and defence. Military history is a subject to which I have devoted much of my attention, and I feel that it is the subject of all others that contains the best instruction for an Officer desirous of being initiated in the art and science of war. I do not know any scheme of instruction that could be desired which would give to an Officer so much valuable information as from the examples to be obtained from the reading of military history. One would like to see old Officers who have returned home from India, and from various other parts of the world, in which they have seen the practice of war, one would like to see such men rendered useful by inculcating some of their acquired knowledge of war on these listeners at the Royal Military College, giving to the rising generation of their brother Officers the benefits of their experience, pointing out to them what peculiarities and circumstances there are in the actual practice of war, as derived from their own experience and the history of the past. Young Officers can see no service at the present time, and it is not much to be expected that there should be any chance at present of seeing service in the field. How, then, can they possibly obtain any knowledge of what actual service is, unless you can convey it by instruction, drawn from personal experience, and the examples of history? I dare say, after all that can be said or done, many of the Officers would go away not much the better for anything that can be said or taught, inasmuch as they might neither care to listen to what they hear, nor to retain their knowledge. But what I feel is this, that there are a great many Officers of a totally different temperament; men who, in the experience of all of us, are not willingly left alone in country quarters, or barracks, to idle their time away, and lead a mere listless existence, if they could attain to any usefulness whatever; and this is by no means a small class: generally speaking the most valuable Officers are found in it, whose natural energies and ambition want to be gratified; and, I think, if these men once acquired a taste for learning and a little instruction, that they might be led on to drink deeper of "the hyperian spring." It is a good thing for a man to acquire a taste for study, but I believe they rarely acquire it from their competitive examinations, where all is mere "cramming," which fatigues and tires them to death. The instruction they would get from lectures upon actual service, given by Officers of experience, would call forth a very different taste for study, and lead them, in a great many cases, to read military history for themselves; if the inducement and leisure were afforded them. I think we have no right to conclude that young Officers would not give their attention to subjects of professional attainment, because, under the present system, they have never been led or induced to do so. I think if they were properly educated and informed upon a better system, they would rejoice in it, and their spirit would be roused to continue their studies in them on joining. I am aware that I am speaking to many military men who denounce all instruction on these subjects, who rejoice in the conclusion that as we have always been "victorious and glorious" wherever we have been, that, therefore, we can do very well without instruction, and that there is no necessity for it. I demur to that feeling altogether. First of all, I deny that the Army ought to claim any very great merit for what is rather the attribute of the nation that makes the Army; it is the spirit of the people, in their highest national characteristic, that makes the Army "victorious "and glorious." But however that may be, I do not see that that is any reason why the Officers of the Army should not instruct themselves, and improve their "victorious and glorious" position by reading. I am well aware that in a matter of this kind I am not likely to find that all who hear me will agree with me as to the employment of all the junior Officers of the Army in military instruction after they join their regiments. But what I want to do is, to ventilate the subject. I am glad to find, from information I have received this very morning, that the Royal Commission on Military Education are about to take into consideration some scheme that will probably lead to this issue. I said a short time ago that it would be better for Officers to learn a little, and that a little mental culture would be advantageous to Officers, and would lead them to acquire more. But there is one other consequence that would, I think, flow from this. We all know how many Officers, in our experience, have retired from the Army after twelve or fifteen years' service, either to marry, or otherwise; these men go away, and they find the contrast of idleness to abstract service so great, that they would give their heads and ears to be employed anyhow. Well, the only pursuits they are fit for, as we know, are to become the governors of gaols, or to take charge of the police. Now, if they were better instructed while with their regiments, and had acquired a taste for instructing themselves, they would be fitted for many other duties, and I am perfectly certain they would obtain employment of a more suitable character. And, indeed, I think the time may come when Government may be pressed to employ these men in Government offices; but at present the Government is less likely to give employment, on account of their insufficiency of much useful knowledge. I will conclude by candidly expressing my individual opinion that the way in which Government manages the young Officers of the Army is, without exception, the most demoralizing and the most injurious to character that can be well conceived, and that it is very little creditable to the British.

Captain S. FARRELL, R.E., Professor Royal Military Staff College, Sandhurst: I think the chief proposition that Colonel Collinson has put forth is this, that "one general school" would suffice; and with that, he would lead us to accept the opinion, that this school should be for training the Artillery, Engineers, and Staff, while the great mass of the service, Infantry and Cavalry Officers would not require special training in a military school, but would be best drawn from the public schools of this country. That proposition must be very attentively considered, because I am sure that Colonel Collinson would be the last man to wish us to deny the truth of the old saying, "Knowledge is power." It appears to me from this paper, and from the remarks made by Sir Edward Cust, that between "twenty and thirty years of age" is considered the best part of a man's life for study. That quite upsets our old notions that the best time for education is while we are young, and that we should be taught when young. I think it most important that the foundation of education should be laid in our youth. We all know what the public schools are; and I do not think the great body of Englishmen will tell you that knowledge, *as knowledge*, is gained by a large mass of boys at public schools. But even if it were; *how* does Colonel Collinson propose to draw young officers from them? If young men are required to pass a test examination, is it not certain that public school boys would compete disadvantageously against those who have been privately taught? You will have no doubt on this point, if you examine carefully the records of Army examinations for many years past. Boys taught, three or four at a time, by an intelligent and earnest man, must have an immense advantage. That is the secret of success in getting into Woolwich; we were first thoroughly taught by a man, whose whole object in life it is to get boys well in, high on the list for Woolwich Academy. I am not now speaking from the point of view of a professor of either of the two junior schools. I have, perhaps, the advantage of knowing what men who have been through those schools are, when they come to the *Staff* College, and I am perfectly certain, that if you wish to have a man fitted to enter the Staff he must, as a boy, be taught the elements of many subjects. For instance, it is most grievous and vexatious to a man of twenty-five or thirty years of age to have to commence the rudiments of drawing and fortification; to be so stiff-fingered, that he cannot make an outline sketch of hills, and to be so tied down to the details of drawing "scales," and the simplest plans and sections in fortification plates, that he can make no progress in the theory or practice of the subject. It is most fatiguing to him. I am perfectly certain that the best education in these subjects must be begun in youth. It has been said to-night that we must speak openly here as brother Officers. Well, what are our present schools? We have two schools, Woolwich and Sandhurst. Now, do people mean to say that those schools are failures? You may hear it said, that Sandhurst cadets coming into regiments are not very favourably looked upon, and objections are made to them. But will you deny that, at least Woolwich Academy has done good work? Sandhurst hitherto has never had a fair chance. I feel convinced that with the progress of events, that Institution can be so ordered as to produce much improved results. I should then vote for two schools in preference to one, because, if you have a monopoly of anything, it must be bad; and if you have the two schools well constructed, well organised, one will help the other. We should go from one school to the other school periodically, and see how each was going on, and take hints where we could improve either. I believe they would immensely, and I am certain that Sandhurst has improved very much of late years; and that it is now in a fair way of doing very well. But Colonel Collinson's proposal ought to be considered, perhaps, from another point of view. He says it is a bad thing to narrow your sphere of education. Is he not by his scheme narrowing the sphere of education for the Staff, which is the most important part of the Army? He says no man should get on the Staff unless, as a boy, he acquitted himself well. Why should you put a blot against a man's name, because as a lad he has not distinguished himself? It may be, and it is so, that some natures do not develop themselves in early life. A man may have been a little wild in his youth, but he might come to the front afterwards. It would be a very hard thing to adopt in our service the plan of only letting those men serve on the Staff who were formerly good boys. I think our present Staff system can scarcely be improved, as far as the Council of Military Education have laid it down. Of course there are many points of detail, which it is not for me to go into; but we have at present a wide field, with, at least, two *special* sources of supply, supplemented by five or six years' subsequent service as regimental Officers, with various other precautions taken as to the fitness of candidates for the Staff College, and to resign or abolish all this in favour of Colonel Collinson's plan would be, I submit, to the disadvantage of the future Staff of your Army. Now to go to another suggestion, how can you expect a young man when first commissioned to go to a regiment and learn as Colonel Collinson thinks he will learn? I maintain it would be doing him the greatest possible injustice. There are no inducements to study, you never could make it easy to study while with the regiment. He must come either alone to a regiment stationed apart, or he must come with half a dozen other youngsters to join at some large station. In large garrisons, or at depôt battalions, half a dozen young men enter the service at the same time. Can you picture to yourself the special inducements they find to study? It is a hard thing to study in a barrack room. It is a difficult thing *for any* man, even the most determined, to surmount the obstacles that beset him. His time is cut up, and frittered away by the details of regimental duties, daily parades, &c., &c., and is it likely that any, beyond a very small proportion, will be proof against these and many still stronger inducements to a life of greater ease, of one of pleasure rather than of work? He has work of a different nature to attend to, and his "head" work ought to have been previously advanced. You would do him far greater justice, and he would have learnt far more at a school, having had an extra stimulus by working with others. I do not know that I should here like to propose any particular system of study, because I have not been called upon to consider the subject very minutely. But I should rather object to taking Colonel Collinson's view of the course of *Entrance* examination, that is to say, putting mathematics first. I think that is against nature. I should put before a lad what nature makes it most easy for him to learn. We know that languages and the imitative arts are the most easy of acquirement for a boy up to sixteen. I should give him plenty of "Languages." Nature not only points out that these are what he can learn best, but they lay the foundation for a gentleman's education, give him a facility of expressing himself, and of mixing with the world. Mathematics, I would rather take afterwards. He should certainly be led to practise drawing, so as to get some freedom of hand, for many have at a later period of life found it difficult to acquire. Of the men who come to the Staff College, those who have been cadets have a great "pull;" they have an immense advantage. That is plain matter of fact, recognized year after year by the members of every fresh batch. But in addition to drawing and fortification (concerning which there can be no question), why should you not teach young lads some science? Why should they not have an opportunity of attending lectures on Chemistry, and have the advantage of a laboratory, which they cannot have in a Regiment? Why should they not have their attention turned to Geology? As Sir Edward Cust says, it is a great advantage to a man in after years to have some subject of interest, and surely you must lay the rudiments of this knowledge with boys. There is one more thing, I should like to say, that is, if you work a boy hard from twelve to eighteen, you ought, I think to give him a holiday for a time—not an unlimited holiday. Nature will not continuously work! work! work! Give him six months or six years of work if you like, but then give him a little holiday. A young Officer, after working from twelve to eighteen, may go into a Regiment, and apply his mind to a new course; he may acquire much knowledge of the world, knowledge of foreign countries, &c., &c., all very essential to his future career; and after a time he will return to study with fresh zest, and will give the whole of his energy to further reading, provided a certain foundation has been laid before. I quite hope and believe that the present discussion by the Royal Commission will lead to a great improvement in our military schools. There is nothing to hinder their being made most valuable, with, improved organization. But no Establishment in this country has ever come to the front, unless it was under the control of some guiding genius. It is so with any successful mercantile establishment (whatever it may be), there is the spirit of some able man who has guided it throughout, and formed its character. This is what we want in these Military Colleges. I do not say he should be a first-rate scholar, but a man who would command the confidence of the young, and be in all respects an able Chief.

Sir Harry Verney, Bart., M.P.: I cannot agree with the sentiments of those Officers who seem to think that it is quite unnecessary for young Officers to be instructed before they enter the Army; because my idea is that an Officer, who has passed a course at Sandhurst, and has learned what he may learn at Sandhurst, is perfectly ready to take the field in active service, and to perform all the duties of an Officer in the course of two or three weeks. I should say it would take twice as many months to one who comes straight from a public school, and who has had no military education whatever. There is one special branch of military education which I think we hardly attend to enough, and which cannot very well be taught in a Regiment. I allude to the facility of rapidly and correctly surveying. I think there is nothing that an Officer ought to learn so much, and to have so much at his fingers' ends, as the power to ride over a country, and then when he gets back to his room or his tent to make a sketch of the country he has been riding over, showing with tolerable accuracy the features of the country, comparative heights and inclination of hills, &c.; that is a subject that ought to be taught. When I was at Sandhurst I was taught it to a certain extent. I believe that many who were cadets with me at Sandhurst were able to run over Bagshot Heath, come back to their rooms, and make some sketch of the country they had crossed. I think that is a branch of instruction which is peculiarly necessary for an Officer; it is not very easily learned in a Regiment, and it is much more easily learned when you are under 20 than when you are above 20. I think what Sir Edward Cust has said with regard to the attention paid to cadets, and the neglect of them when they become Officers, is a matter of the greatest possible importance. I daresay many Officers here have been present at reviews in foreign countries. I have been present on several occasions, and have been very much struck indeed, with the knowledge of practical warfare which is acquired by the Officers of the different *Corps d'armée* in Prussia, France, and Switzerland. In Prussia the different *Corps d'armée* manœuvre against each other. It is left to the ability and knowledge of the Officer commanding, and of the Officers of his staff, to manœuvre these bodies of troops against each other, as they would in actual warfare. We could perfectly well acquire that knowledge in our own country; I do not see why we should not. It would be extremely interesting to all military men, and I believe we should all learn a great deal by the practice, and that in exercises of this sort it would be found out which

Officers naturally possess that military ability. The sort of military ability to which I refer, is born with men. There are some people, possibly the ablest men in other knowledge and acquirements, who have no power of topography. I have been walking in the Mall in St. James' Park with Baron de Bunsen, the most learned man perhaps with whom I have ever been intimate, and he has said to me, "I do not know whether the Horse Guards or Buckingham Palace is in front of me, unless I see them." He had no knowledge of topography; another man has a map in his head, and an intuitive knowledge of locality; it was born with him. That is the very knowledge without which a man cannot be a great soldier. It is quite impossible that such a man can ever be a Quartermaster-General, or can command an army well. The great thing is to ascertain, what men possess that special talent by nature, and then to develop it to the highest degree. I believe it can be much more easily ascertained at a Military College than at a public school, or in a Regiment in our present regimental life. You find out at a Military School who has the talent. Sandhurst has been spoken of slightingly. Now, I think we learned a great deal at Sandhurst, and I have no doubt that we might have learned, but for our own fault, a great deal more. If any of us had gone out to the Peninsular war, I believe within a fortnight of our joining we should have been perfectly fit to be trusted to march a company across the country, if necessary, to throw up field fortifications for sudden defence, or attack those of the enemy, or to describe the country on paper. I think a man may learn all that at a Military School, which is of the most essential importance to him in service. It is all drill in time of peace, and you may have time to learn these things. But suppose we are engaged in war, a cadet sent from a Military School and getting his commission would be able to go at once to the scene of war, and to protect himself and his men; therefore, I am certainly of opinion that Military Schools ought not to be dispensed with, and I think with the Officer who spoke last, that they might be made very useful and very practical. I hope the Military Commission now sitting to consider the question of military education, will suggest something of the sort, with the view to improve the knowledge of Officers in the Army. It would also render the service more interesting and attractive, because I believe the more our Officers are educated, the more interesting they will find the service, and the more they will be attached to it.

Colonel C. ROBERTSON, Commanding 2nd Battalion 8th Regiment: I have but few observations to make. I shall endeavour not to go over any of the points which have been touched upon by Sir Edward Cust, or the gentlemen who have just spoken. I look upon the Army as a great training institution; in time of peace we all know that it is nothing more than a gigantic school. I think every Commanding Officer who appreciates properly his duties must feel that they are essentially those of a schoolmaster, and that his efficiency as such, mainly depends upon his success in training the Officers and men under his command to fulfil certain duties, and to perform certain exercises. He has no doubt other duties to perform, administrative duties, the duty of carrying out discipline and conducting courts martial. But I have always felt that my essential function was that of a schoolmaster. Consequently, I have taken a great interest in all questions of education; I have read everything that has come in my way both as regards the education of civilians and the education of the military. The conclusions I have come to I will endeavour to state in a few words. To make the subject clearer, I will separate the education of the military Officer into different parts—the preliminary education before he gets his commission, and then that which he receives after he joins his regiment. As to the preliminary part, all I should say is, that I entirely agree with Colonel Collinson, that special education is not required, that it is positively hurtful. I think we cannot do better than take our Officers from the public schools. Experience proves that they make the best Officers; but besides appealing to experience, I think I could give reasons that appear to myself worthy of consideration. Why Sandhurst, where no doubt the course is excellent, where the professors are eminent men, and where there is great zeal shown in teaching, does not produce the effects that it might be expected to produce; the reason of this partial failure is the same that was given in the case of the public schools for the comparative failure of the immense expenditure of time and money to produce good scholars. It was said that at Eton the boys were the sons of men of rank and fortune, and that they had consequently no inducements to learn, they were very idle, and many of them turned out to be indifferent classical scholars. Now, I think the same cause which renders the education of Eton boys a partial failure applies with great force to Sandhurst. I will not say that an Officer is always the dunce of the family, but the majority of young men that go to Sandhurst for commissions are not young men of studious dispositions. If they go into the Cavalry or Infantry, they know that their deficiencies, whatever they may be, will not prevent their getting commissions. Therefore, I say, the men that go to Sandhurst are not men that go there with the intention of studying hard. You collect together all the idle young men of the country, and then you expect good results. Certainly you ought not to expect them. Let the teaching be ten times better than it is, and you will still get bad results if you put all the idle together. This consideration accounts for what is certainly a fact, that the young men who come from Sandhurst are not, generally speaking, good scholars; the reason is they are not generally young men of studious dispositions, and that they are all collected at one place. I think if they were scattered at different schools, at Harrow, at Eton, at Rugby, you would have better results. I shall say very little more on the preliminary education of Officers, except this, that I wish it was extended a little more. I wish the ages at which Officers get commissions, instead of being from 18 to 20, were from 20 to 22, so that we might have young men from the Universities, of whom there are very few in the Cavalry and still fewer in the Infantry. I think it would be a great advantage to have more University men in the Army. Any young men joining the Army with a degree, I should put senior to every Ensign who did not possess some equivalent certificate. When he joined the regiment he should not be put at the bottom of the list of Ensigns, but he should be put above every Ensign who had not received a degree or other certificate requiring an equivalent amount of labour. Eighteen is the age young men leave the public schools and go to the Universities. At eighteen I should have an examination, similar to the Indian Civil Service examination, to select candidates for commissions without purchase.

In the Civil Service examinations no special subjects are prescribed, but the candidate is allowed to select any subject taught at the school in which he has been brought up. Candidates for commissions without purchase should, I think, be required to pass a preliminary competitive examination admitting of the same latitude in the choice of subjects. The successful competitors should receive conditional nominations to commissions, confirmation being dependent on the nominee within three or four years either obtaining an University degree, or else obtaining a certificate of having passed such an examination as evinced a competent knowledge of such subjects as might be prescribed for a special course of military studies extending over the same period of time as is required to obtain a degree.

I think such a system as this would produce better results than the present system of bestowing commissions without purchase exclusively on Sandhurst cadets.

The best men of a single school, and that an exceptionally idle school, could not possibly be so good as the best men of a set of competitors drawn from all the schools of the country both public and private.

I will go on to state what should be done with young men when they join their Regiments. There is nothing more difficult than to get young Officers of Cavalry or Infantry to do this kind of work; even to teach them their military duties is difficult. The system of regimental instruction is very monotonous and uninteresting, and there is no inducement held out for Officers to work voluntarily at extra studies. With the exception of a few men who go to the Staff College, the others have, generally speaking, no inclination to study. It is very difficult to devise any plan of instruction that will operate upon the whole mass of Officers. I myself should consider such an attempt as quite hopeless. In this respect I differ from Sir Edward Cust. I think such a plan as he indicated, would result in ingenious evasions and delusive shams. I feel sure that any attempt to make instruction systematic and study obligatory, would be intensely disliked, would be pertinaciously resisted, and would produce no good result. I do not therefore consider it advisable or practicable to attempt to render the instruction of Officers systematic and compulsory in any other subjects than those which are essential for the due performance of the daily routine of regimental duties, and in which, by existing regulations, Officers are required to pass an examination in order to render themselves eligible for promotion. As regards other subjects, the only plan which seems to me the least likely to produce any good results is by suitable inducements to encourage Officers voluntarily to devote themselves to certain studies, and to acquire such kinds of knowledge and skill as it may be thought useful and desirable that a certain proportion of the Officers of every Regiment should possess.

The difficulty would be to devise some inducement which would prove an effective motive to study. I do not think the present system of selecting Officers for promotion good. The purchase system is, I think, a very bad one, but I doubt if it would be an improvement, to substitute for it a system of regulating promotion by mere scholastic attainments. I think to reward such attainments by promotion would be very objectionable for many reasons; but I do not see any objection to rewarding them by increased rates of pay. This is the only inducement to study which I can think of, which in the present state of our military institutions, and while the present system of promotion is maintained, seems the least likely to prove practically effective. Let us, for instance, say that an Officer devotes himself to the study of French, and is certified by an Examiner appointed by the Council of Military Education to have made himself thoroughly master of the language, that is, able not merely to read it, but to speak it fluently, and to write it grammatically. I should say this acquirement would be well worth a shilling, or even eighteen pence a day. This extra rate of pay I would grant, not permanently, but only for a limited period, say two or three years. At the end of this period, the Officers should be required to pass another examination, success in which would be rewarded by the grant of extra pay for another term. This would ensure knowledge, when once acquired, being kept up. To encourage the study of military history, and of the theory of the art of war, a similar plan might be adopted. Each year one or more campaigns and also a theoretical treatise might be prescribed for study, and an extra rate of pay granted for one year to all Officers adjudged by competent examiners to have made themselves thoroughly masters of the prescribed course of study. The study of mathematics, or the practice of drawing and surveying might be promoted in the same way. In fact, what I say is:—encourage excellence of every kind; encourage voluntary effort. Offer some suitable reward for the acquisition of any kind of knowledge or of skill in any art, which knowledge or which skill is susceptible of a useful military application, and which it is therefore desirable that Officers should possess. Possibly some merely honorary reward might be devised which would prove a sufficient inducement to promote voluntary study, such, for instance, as permission to wear the undress uniform of the Staff, or distinctive initials in the Army list.

The effect of such inducements might easily be ascertained by actual experiment. My own opinion is that a mere honorary reward would not prove sufficient. Officers would feel that money is the real test of value -that labour repaid only by a complimentary order or by some purely honorary distinction was in reality, labour lost—that their attainments, however great, whatever might be their intrinsic worth, had no real professional value. In 1844, on rejoining my regiment in Dublin after a two years' course of study at the Senior Department of Sandhurst, I was asked by the Commander of the Forces, Sir E. Blakeney, to make a survey of the Phœnix Park, on a scale of six inches to a mile. On completing my plan I showed it to Sir T. Larcom, who was then at the head of the Irish Topographical establishment. Sir Thomas laughed and said, "Yes; the plan is well enough done, and I dare say "you will get a civil letter from the Adjutant-General in return for it; but what "good will that do you? The authorities have no use for such things; they have "plenty of them, some as large as this carpet, some only the size of a sheet of note-"paper. They are all equally useless, and are only asked for as a matter of "form."

If there be any increase of efficiency, any real military advantage to be gained by inducing Officers to devote their leisure time to the acquisition of certain arts and sciences, then that advantage must be worth paying for—must have a certain money value, be it more or be it less. Even a very small sum expended in the way I have suggested, that is, rewarding special attainments by extra rates of pay, would, I imagine, produce a very considerable effect in inducing a very numerous body of Officers to devote their leisure hours to study and to compete for the rewards offered.

There is one point, and only one, in which I totally disagree with Colonel Collinson. I think it a false principle to determine at the time a young man leaves school and receives his commission what his future career shall be; to say, "You have been dull, or you have been idle, or you have been dissolute and reck-"less; or, if not, if your abilities are good, if your conduct has been irreproachable "and your diligence exemplary, nevertheless, no matter why, you have failed; "A, B, and C, have passed a better examination than you have, therefore, henceforth "for ever they shall be first and you shall be last; you shall never compete with "them again. For the future, success is impossible, therefore exertion is useless. "The doors of the Staff College are closed against you; there is no avenue open "through which you may reach future distinction." Now, many a dull idle boy turns out an intelligent industrious man—many a worthless cadet an excellent Officer, nor are examples rare in which the reverse of this happens, when the promises of youth are not fulfilled by what is accomplished in after years. Therefore I say, let every Officer who receives a commission, be encouraged to exert himself. Let him who has been successful at school be encouraged to persevere; let him who has failed be encouraged to try again; let all be incited to work. Let the doors of the Staff College be always open to the first; let it never be too late to begin the race. Let the present system of selecting Officers for Staff appointments be maintained, and Colonel Collinson's proposal, rejected. More than that, we know there are only a certain number of vacancies on the Staff, and that there are not sufficient openings to reward every man who succeeds in the Staff College. Therefore, I think it desirable that every man who passes the final examinations with credit should, in addition to the chance of a future Staff appointment, have some certain present advantage. Allow him, for instance, to wear the undress uniform of the Staff, to have certain initials put against his name, and let him also have some substantial reward, eighteen pence or half a crown a day. Until appointed to vacancies on the Staff you might utilise the service of these men by employing them as regimental instructors. But, whether their services can be utilised or not, I think by the mere act of their having gone through a special course of study, and having prepared themselves to serve the country in the capacity of Staff Officers in any emergency, such as war, which requires an increased Staff, they have performed a real service, which is well worth paying for. I think it would be mere justice and a wise expenditure of money to give such men a retaining fee of two or three shillings a day. A little knowledge of accounts, a little knowledge of drill, a little knowledge of military law, all of these are absolutely essential, and instruction in them must be compulsory. But beyond these essential things, I think all work should be voluntary, and should be rewarded by extra pay. I would not attempt to say to Officers, who as a body dislike study and would not care to spend their time over books, "I insist upon your studying," unless I was prepared to reward them for their proficiency. Unrewarded study, if compulsory, would, I feel sure, degenerate into a sham. Moreover it is not necessary, nor even desirable, that every Officer should be a student. All Officers cannot be on the Staff. For leading troops, which is the chief and essential duty of a Regimental Officer, what we chiefly want are qualities not to be acquired by study, we want daring, pluck, and common sense, or rather what Colonel Collinson calls the imaginative faculty, quickness of perception, and readiness of resource. The very best Officers in the junior ranks do not want any theoretical knowledge for the perfect performance of their special duties: they want good nerve, good practical common sense, and daring. Let us utilise the talents of everybody. If an Officer is a student, let him be rewarded by Staff appointment suited to the extent of his attainments. If an Officer is averse to studious pursuits, but possesses qualities of character more valuable in war than quickness of intellect and a studious disposition, actual service in the field will afford him abundant opportunities of proving his worth, and of acquiring distinction. Let such an Officer be rewarded by rank or honours proportioned to the value of the services he renders.

Captain MARSH, R.E.: There are one or two points I should like to mention which I hope Colonel Collinson will clear up in his reply. I cannot conceive that he means to propose, as it has been supposed by two Officers, and as this paper gives the impression, to limit the Staff appointments of the Army to those cadets who qualify in this school. I cannot conceive that he means that, nor, for one moment, do I believe that. Therefore, I hope he will clear that point up in his reply. Nor do I gather from his paper how Colonel Collinson proposes the examination should be conducted on leaving the school. I rather gather from what he says, that the three special branches of the Service, which he alludes to, should be open to those cadets of the school who qualify in special subjects. I do not quite understand whether he means that they should all meet together in a competitive examination, or that the cadets who are going for Staff appointments, should be examined in the particular studies he adverts to, or whether they should all study together and take rank accordingly. If he intends that, they should select one of the three branches, and then only those cadets be examined for their places in that particular branch of the Service. I think that would be well. But I think it would be unadvisable to examine all the cadets together, and then bring them out according to their places, 1, 2, 3. I think that is the great question in these establishments of a special nature. I do not think, under any way of looking at it, that it is desirable to have an inferior class of men in the line, and a superior class of men in another branch of the Service. I think they each want the best men.

It is quite a question whether the difference, which I believe is generally acknowledged, between Sandhurst and Woolwich, is not due to the fact that there is a stronger competition at Woolwich; there are the two distinct services; the Artillery and Engineers, and that induces competition. There are a number of cadets who go to Sandhurst, who never think of competing at all; and in that view there are a number of boys there who never do anything, and they get their commissions without purchase. I think that is a bad thing for Sandhurst, but it is very difficult to see how it can be avoided. The same kind of thing obtains in a less degree at Woolwich. I think all who have been at Woolwich will allow that there were a certain number, a very limited number, who felt that they should go into the Artillery, and who did not care very much about working,—they felt tolerably certain of getting into the Artillery. That was not a good thing. As regards the proposal to throw open the whole of the commissions in the Army to competition from the public schools, there cannot be a doubt that for the country in general it would be a great advantage. I think we must also look at the question from this point of view. Many Officers after they have served twenty years in the Army, go back into the country, and take their part as citizens in different walks of life. Therefore, to throw open three or four hundred commissions in the Army as premiums to the public schools of the country, would be a very great gain. In that view I think there is a great deal to be said in favour of electing to commissions in the Army from the public schools of the country.

Lieutenant-Colonel OWEN, R.A., Professor of Artillery, Royal Military Academy, Woolwich: I should like to say a few words after the remarks of Captain Farrell. There are several points which I might have alluded to, but it will be unnecessary for me to mention them now, because they have been so exceedingly well put by Captain Farrell, that it will be enough to say I entirely agree with him. But there are two or three points I should like to refer to, with regard to Colonel Collinson's paper, and also with regard to what has been said by one or two of the speakers. The idea of Colonel Collinson seems to be a school for the Artillery, the Engineers, and the Staff. I cannot help feeling myself that such a plan would cause a very great complication in any establishment devised for that object. At the Royal Military Academy at Woolwich, we have the Artillery and Engineers trained; and although they go through precisely the same course, there is sufficient complication to create considerable difficulty. And I must say, as far as I am concerned, and I have no doubt there are a great number of Officers who agree with me, that it would be a great pity to separate the Artillery and Engineers at Woolwich. The services are so intimately connected, that every Artillery Officer must feel that he requires to have a considerable amount of knowledge of fortification. On the other hand, every Engineer Officer must feel grateful for what he has picked up at the Royal Military Academy in the way of artillery knowledge. Therefore, I consider it would be a great evil to separate the preparatory courses for these two Services. I consider the same course should be gone through for Artillery and Engineers at the same school. As regards the rest of the Army, I should be disposed, like Colonel Collinson, to trust to the public schools; and if it is thought desirable by the authorities, or whoever might have charge of the subject, instruction should be given to line Officers, after they get their commissions. I think this must be perfectly clear, that, if Officers joining any branch of the service are required to know military history, surveying, or subjects of this kind, it would be perfectly impossible to instruct them by twos and threes in different places; you must teach them together in certain classes at the Military Schools. With regard to the necessity of having a college for the Artillery and Engineers, one good argument in favour of such a course is this, that it is found necessary in every nation in Europe. Independently of that, I think there is so much special knowledge required for the Artillery and Engineers, that it would be very disadvantageous, indeed, to turn Officers into those services, not knowing anything at all about them. To take my own branch of the Service, the Artillery; in the Crimea we received a number of Officers direct from the Academy, and a number of Officers were sent out in the same manner to India during the mutiny. Now, it would have been most prejudicial to the service if they had known nothing of their own branch of the service when they came out. I say those Officers, coming out with a certain amount of training was a great advantage to the Service. With regard to the preparatory training for Woolwich or for Sandhurst, I should like to see more men come from the public schools. Everybody knows what inducements have been offered by raising the qualification in classics, and lowering the qualification in mathematics, to get boys from the public schools. It is the fault of the public schools themselves if they do not send more. There are certain examinations laid down for the Military Colleges; several public schools have formed special classes, and have been successful in sending boys to Woolwich and Sandhurst. I may mention Cheltenham, Marlborough; and there are others; why cannot the other public schools do the same thing? No doubt they would, if a sufficient inducement was offered. We heard the other day that the Head Master of Harrow intends to form a special class there.

Lieutenant-Colonel **Keppel**, Gren. Gds.: Eton already has a special Army class.

Lieutenant-Colonel **Owen**: With regard to the state of the Military Colleges, I should just like to say one or two words. Constant complaints are made in a popular way as to the state of discipline, and so on, at these different schools. If there occurs a little outbreak, there is a hue and cry raised throughout the country, "What a dreadful place this must be!" If you were to apply the same rule to all the public schools in England, you would hear of mutiny and disturbance almost every day; because most of these so-called mutinies at the Military Schools are matters that would be passed over anywhere else. At Woolwich, I must say, as far as my own experience goes, I think the tone has considerably improved during the past few years. I do not know what the case is at Sandhurst; but with regard to Sandhurst, there are two very obvious reasons why you do not get such good results from it as you do from Woolwich. One is, that the young men have to be there such a short time; the other is, that they have not a sufficient inducement. Any young fellow knows that his friends can buy him a commission; therefore, why should he work? If that is the case, it is a very obvious reason why you do not get the good results you might expect. By keeping the young men longer there, and by not allowing anybody to pass through unless obliged to try for a commission, you might get better results. With regard to discipline, I must say this, I have been a certain number of years at Woolwich, and during the whole time I have been there, I have never had the slightest trouble with the cadets. I am quite ready to admit that in steadiness on parade and that kind of thing they are not up to the mark that they were formerly. But as to gentlemanly tone, they are up to the mark. I have never received the slightest impertinence; they always behave exceedingly well, and are always amenable to orders. Compared with former years, there has been a great improvement. In 1846 or 1848 the Academy was in an exceedingly bad state. By two officers, General Parker and Captain (now Major-General) Wilmot, the discipline was, however, restored in the course of a few months; and as long as I was there we were always considered in a very excellent state as regards discipline. It is now very late, and although there are one or two other points, I think I have said all that it is necessary to trouble you with.

The CHAIRMAN: I am sure that we all owe a debt of gratitude to Colonel Collinson, not only for having written this paper, but also for the opinions that his paper has been the means of eliciting from different Officers present at this meeting. I have no doubt the discussion will be of very great use. At this late hour of the evening I will not make any further observations. I cannot pretend to answer all the questions that have been asked with regard to Colonel Collinson's opinions. I will, therefore, only propose that we return our thanks to Colonel Collinson for his paper.

LECTURE.

Friday, April 23rd, 1869.

General the Hon. Sir EDWARD CUST, K.C.H., G.C.L.,
in the Chair.

MILITARY TRANSPORT.

By Frederick Wingfield, Esq., Deputy-Assistant Commissary-General.

The question of "Military Transport," upon which I am about to address you, is I feel of such importance, that I venture to trust to your forbearance should I fail to do justice to my subject.

I would first endeavour to urge upon your consideration the imperfect manner in which this question has hitherto been appreciated, and the diminished importance that has been attached to land transport as an integral portion of our Army. The origin and progress of the establishment of regular transport; the recognition of the inseparable connection between transport and supply; the form of organization to be adopted; the authority to which the duty of controlling the train should be entrusted; and the description of transport to be maintained, will severally be reviewed and discussed in this lecture.

Except under the pressure of actual warfare, we have never until lately recognized in this country the existence of an organized Transport Corps, as an indispensable branch of any national force. In the wars that we have carried on in distant countries and colonies, special descriptions of transport have been extemporized for the occasion. At times wheeled transport or pack animals, at others boats and men have been employed for the conveyance of the necessary supplies. On the completion of the campaign, such transport establishments have been summarily broken up; and, until occasion again arose, the consideration of the principles which should guide our action, have been indefinitely postponed. To the days of the Peninsula and of Waterloo, a long period of inactivity succeeded. For 40 years we remained passive spectators of military progress in Europe, and when the Crimean struggle aroused us to exertion, we found ourselves helpless to create, and incompetent to administer those branches of the Service, which should have been matured in the repose of peace.

The rapid overthrow of Austria in 1866, and the admitted superiority of the Prussian administration over that of their opponents, convinced all spectators of that struggle that radical reforms in their own armies had become imperative, and that their feelings of security were as mistaken as they were perilous.

In June, 1866, a Committee was appointed by the Secretary of State for War for the purpose of taking into consideration the subject of the arrangements to be made for carrying out the transport duties of an army in the field, in order that such measures should be determined on in time of peace, as would prevent the uncertainty and confusion which would arise on the outbreak of war, if the system to be adopted, had then to be settled.

To Lord Strathnairn and to the Committee under his presidency this country should ever be grateful, although years may probably elapse before we shall be able to appreciate the extent of the obligation. The exhaustive report submitted by them on the termination of their labours, and which embraced the more extended subject of military administration has proved the prelude to the introduction of the system of "control," which, while it follows the practice of all Continental powers, has been adjusted to the peculiar character of our own Service, and the principles of our Constitution.

It was the boast of our greatest Captain, that his Army, though small in numbers, could do anything, and go anywhere. No one ever impugned the former assertion, as true of to-day as of 50 years ago, but are any of us satisfied, as to the truth of the latter portion of the sentence? Can we possibly say that our Army is in a condition to go anywhere by a given time, or to attempt any operation independently of the gravest doubts as to our capabilities of movement? Are we as ready as our neighbours, and could we take the initiative, and have we any transport worthy of the name, either in men or material? Have we, in short, at our immediate disposal those means of conveyance, or (what is of more importance), the machinery by which they could be rapidly created, from which we might confidently anticipate success in the operations we might attempt?

To our insular position much of this national propensity to underrate the importance of "transport" may indubitably be ascribed. While we retain our supremacy as a Naval Power, or while our ability to cope at least on equal terms with maritime nations, is undisputed, we do not feel that insecurity, which is inseparable from a Continental status, where a river may be crossed, or an imaginary boundary may be overstepped, without further warning, than the angry menaces which precede the declaration of war. Our forces are not, and probably never will be, kept in that high state of mobilisation, which characterises the French and Prussian armies. We feel that before the note of war can be heard on our soil, fleets of transports must be collected, and an armada be gathered together, in which the enemy may attempt invasion; and even should these preparations have been completed, the Rubicon cannot be crossed, until our truly national force, our Navy, shall have disappeared. We know that such preliminaries require time for their arrangement, and we are not unwilling to postpone our preparations until the cloud is over us.

But in this unreadiness for action, in this state of inability to resist aggression, lie the elements of danger. Wars are not now conducted on the precise system of theory and method that once prevailed; rapid movement, decisive action, and energetic measures now characterize all military operations. The Army that is the most complete in equipment and organization must be the best prepared for rapid action, and will enter upon a war with every prospect of success. The struggles of 1859–1866 confirm the view, that a campaign may be a question of weeks and not of years, of days and not of months. Short as was the period for preparation awarded to the Austrians, shorter was the time of rest between each successive defeat, until their power collapsed before the energy and vigour of their enemies. And shall we not profit by that lesson? Shall we not learn that our very condition of unreadiness will be an incentive to aggressive measures on the part of our opponents, who will attack us because we are unprepared, who will assail us because we are unable to retaliate. The fact of our being unprepared cannot be disguised from other nations, they will find in our weakness an inducement to run counter to our views, and to risk the consequences of an opposition to our policy.

While few now contest the principle that an efficient transport should form an integral portion of an Army, the theory of the constitution and organization of such transport still forms matter for conflicting arguments. Some urge that the native transport of any country that we might invade, would contribute mainly to our help; while others would suggest reliance upon a train, to be raised and organized at the seat of war. Some proclaim the physical impossibility of sufficient transport being despatched from England to the seat of war, and all agree that had we an extensive train, we should be unable to find remunerative employment for it in time of peace. With a view to a happy combination of economy with efficiency, the transport must be so organized that while only sufficient for our immediate wants in time of peace at home and in the large garrisons abroad, it shall possess the elements of expansion to all possible requirements in time of war. In peace the nucleus, or embryo of a train, will satisfy our necessities, and economy forbids infringement on this rule, but the corps that shall be raised must be organized on the most elastic principles; contracted within the narrowest limits in time of peace, it must be capable of indefinite expansion and augmentation in time of war.

This theory has not yet been reduced to practice, but the opportunity has come, we are on the eve of re-organization, and an Army Transport Corps will shortly take its place in our Army List. While a subject of such national importance is under consideration, an enquiry into the origin of "military transport," and the influence it may have exercised in warfare, cannot be uninteresting or unprofitable.

It is to be regretted that so little information as to the manner in which the supply and transport duties were organized and conducted by the Generals of old has been furnished by military historians. No precise details are forthcoming, although we are aware that by several of such leaders (and we will mention Cæsar and Aurelian) they had been studied and reduced to system. The subject is, perhaps, uninviting. The means of success are uninteresting in comparison with the end, which furnishes the brilliant themes to the historian or biographer. The anxious forethought and prescient care with which every detail shall have been calculated, every difficulty overcome, and the existence of the troops secured, before the great stroke of strategy can be played, must naturally fail to rouse the eager interest and keen anxiety that the description of the actual struggle and result can excite. Yet in a campaign, how few are the hours of battle compared with those passed in preparation. How short the time of actual conflict when contrasted with the long delays before successful combination can be ensured, and every possible exigency be anticipated!

The extent to which the consideration of transport can influence the action of a Commander, may be estimated, when we think of Xerxes with a train of baggage-waggons seven miles long for an army of five millions! Herodotus, to whom I am indebted for these statistics, and who does not enjoy the best of characters for veracity, may have been guilty of exaggeration, but if we remember what hordes of followers have ever been attached to Asiatic Armies, and also that the "crack corps" in the Persian Army "the Invincibles," were allowed to take with them into the field, their wives, slaves, and concubines, we shall modify our surprise, and ponder over the march of intellect, which forbids such luxuries even to our "slashers" and "die-hards" at the present day.

That Xerxes and Darius did maintain large armies in countries comparatively unproductive, and that at subsequent periods the hordes of savages, who overran these territories, did contrive to support themselves without difficulty, are facts that have been characterised by General Jomini as phenomena for which he was at a loss to offer an explanation. He could not discern that they appreciated the necessity of transport, while they notoriously disregarded the principles of administration.

The Greeks, according to Thucydides, were attended by slaves and beasts of burthen, for the conveyance of their provisions and necessaries. Philip of Macedon, however, compelled his troops to carry their own arms, provisions, and baggage, and allowed but one slave to every horseman, and one to carry a hand-mill for every ten foot soldiers.

Hannibal, who considered Alexander as the first of Captains, and who in his turn was held by the Duke of Wellington to be the greatest military genius of old, attempted to rise superior to considerations of supply and transport; the loss of two-thirds of his Army convinced him of his error.

The perfect organisation of the Roman Armies, and the excellence which they attained in administrative science, effectually precluded the possibility of failure as far as transport was concerned. While Cæsar proclaimed the doctrine that war should support war, he studiously reduced the impediments of a baggage-train by the formation of depôts in each conquered province. The Romans were essentially road-makers as the vestiges of their skill attest to this day, and they realised the value of good roads as the means by which they could retain their hold upon the provinces they had subjugated. Efficient transport necessitates attention to the means of communication; good roads enables them to accumulate supplies in every direction, and to provide against the contingency of disaster or want; but the excellence of the roads also enabled the Roman soldier to march excessive distances under enormous loads, and at times to carry his provisions almost independently of the aid of transport.

We are told by Froissart that on one occasion, when King Edward III invaded France he was accompanied by a train of 6,000 waggons, which extended for two leagues. As the district which he traversed had been repeatedly ravaged and become impoverished, King Edward could not have ventured to rely upon the resources of a country in such a plight, but had the province he invaded been prosperous and highly cultivated, he would not have hesitated to support himself by exactions and rapine.

It is, of course, hopeless to seek for traces of organized transport before the time when the advantages of systematic administration were appreciated. In the middle ages, while clemency to an inoffensive population was derided, and the impolicy of an exhaustive system of plunder was not recognized, pillage was encouraged by the leaders, as the most convenient mode of supplying mercenary troops. Transport was not required for supply services on their account; they took what they wanted, and as it could be got. Ambulances had become obsolete since the Roman Empire. The material of war had not then developed to the proportions it has attained in modern days, and such transport as was required could be obtained by the appropriation of the carts and animals in the vicinity. The inhabitants had the option of surrendering their property or their lives. Friend and foe were equally indiscriminate in their exactions, and the wretched peasants were the victims of either party.

With improved weapons, superior tactics were introduced. Complicated operations and subtle combinations, involve due regard to considerations of subsistence. Before troops can be condensed upon a given point, or simultaneous movements can be made upon a given day, administration must have contributed its aid. The functions of "transport" in facilitating this end were by degrees developed into the semblance of a system.

In the time of Queen Elizabeth, an Officer, styled "the Waggon Master General" not only exercised direction over the transport of an army, but also held supreme sway over those ladies whose attachment to the service induced them to forsake the towns for the attractions of a military life. He was empowered, according to Sir James Turner, to classify these ladies, with due regard to the rank of their husbands, and although the regulations of the service were imperative as to the necessity that every woman who accompanied the Army should have a husband in it, there are such extraordinary allusions to the punishments which might be inflicted, and such disparaging expletives applied to certain ladies, as to leave little doubt upon the easy tone of morality that existed in our camps.

In the Thirty Years' War, owing to the luxurious habits of military men, and the numerous retainers and women who accompanied them, the amount of baggage had increased to an extent that would appear incredible at the present day. In the Imperial Army, the allowance of baggage waggons exceeded that in force in either the Danish or Swedish forces, but 1,000 waggons for 5,000 cavalry and 100 for their sutlers, was not considered by the great Gustavus as an excessive proportion. In the time of Henry IV of France, one horse was told off to carry the baggage of four soldiers, and one, for that of two light horsemen, or archers. A boy or goujat was allowed to wait on every two soldiers, so that for an Army of 10,000 infantry, 2,500 animals and 5,000 boys were required. These boys are energetically characterised by Sir James Turner as "the very vermin of an Army."

Up to the close of the 18th century, the transport services of European Armies were mainly performed by contract. The contracts for supplying the great Duke of Marlborough, in Holland, were entrusted to Dutch capitalists, as we gather from his despatches; and during the Seven Years' War, a Mr. Oswald was for some time the superintendent of the English and Hessian waggon trains, which would appear to have been so ill-managed as to have most materially impeded the operations of the Allies. The French Armies were in no better plight. Impressment and requisitions upon local magistrates but too often failed to supply the deficiencies of their contractors. Carriages and harness, provisions, fuel, and forage, and advances of money, were furnished by the French Government to these men. Young soldiers were lent to them to act as conductors; but the principles of order, regularity, and discipline were so gravely affected by such arrangements, that at the close of the war, the formation of an organized train had been decided on.

The same feeling was in existence in this country. The repeated complaints of Prince Ferdinand of Brunswick as to the inefficiency of his transport service, suggested to our Government the propriety of an established train. A Treasury minute of 1762, refers to an offer of Mr. Dundas, then contractor for waggons in Germany, to transfer to the Government his waggons, 500 in number, with horses and drivers complete, for the sum of £88 10s. each, it having been for the first time proposed to form a public transport establishment.

In the introduction of this reform we appear to have anticipated the French. In 1794 the "Royal Waggoners" were established. This corps was composed of 9 troops, of 60 rank and file each. The Officers were chiefly taken from the half-pay list of the reduced cavalry corps, and the men and horses almost entirely from the regiments of fencible cavalry that did not offer their services as volunteers. This experiment terminated in utter failure. The inefficiency of this corps became too notorious to allow of its protracted existence. The train was sold, and every purchaser of not less than twelve waggons was admitted to the advantages of a contract for the number of waggons which he had purchased.

The Royal Waggon Train created by the Duke of Wellington became eventually most efficient, but as it was attached to the Quartermaster-General, and was principally, if not entirely, composed of spring-waggons intended for the conveyance of the sick and wounded, their services were not generally available for commissariat duties. In 1812 a train of commissariat carts, each drawn by two bullocks, was organized, and proved eminently useful, but the great portion of the transport required for the conveyance of supplies was still obtained by contract and hire, in compliance with established custom.

In proof of the extraordinary attention bestowed by the Duke of Wellington upon every subject connected with the administration of his Army, I must allude to the three memoranda prepared by him, and forwarded to Sir Robert Kennedy from Grenada in November, 1811, containing his instructions as to the formation of a bullock train of 800 carts, which should be fitted with axletrees and brass boxes taken from the French carriages. With rigid exactitude the Duke enters into the most minute details as to the number of animals, the strength of the establishment, the rates of pay, the rations for man and beast, with the stages to be accomplished daily. He lays down the precise distances which the mules should travel, the number of leagues which should separate magazines from depôts, and the time that should be occupied upon each service. No detail appears to be beneath the grasp of an intellect which could at once comprehend the most extensive operations, and the smallest minutiæ of each special department.

In countries friendly to our cause and materially interested in the operations we had undertaken—in Spain and Portugal, for instance—we should naturally expect that great facilities would have been offered to our administration. But the defects of an imperfect system were ineradicable. Uncertainty and unpunctuality resulted from these contracts, and indifference and disobedience argued the necessity for that control which discipline alone could give. To what extent our operations were impeded, our triumphs nullified, and our cause jeopardised from want of transport, the despatches of the Duke of Wellington will best prove.

In 1809, after the battle of Talavera, the Duke addressed the following remonstrances to Lord Castlereagh:—"I have not been able to "follow the enemy as I could wish, on account of the great deficiency "in the means of transport with this Army, owing to my having found "it impossible to procure even one mule or a cart in Spain.

"I am doing everything in my power to procure for the Army "means of transport and provisions. I hope I may get some of the "former that may reach me in three or four days, and in the meantime "my Army may get something to eat."

On the 31st of August, in the same year he wrote to Mr. Frere, "I positively will not move, nay more, I will disperse my army, till I "am supplied with provisions and means of transport, as I ought "to be."

In 1811 the Duke wrote from Villa Fermara to the effect, that he had no transport, had been compelled to send back guns to Madrid, and to pick up French shot in his camp, in order to make up ammunition for Arentschild's guns.

In the following year the Duke of Wellington reports from Ciudad Rodrigo to Lord Liverpool, 23rd of November, 1812: "I had ample "means at Madrid and Santander for the siege of Burgos, but what "was wanting at both places was means of transport. The people of

"England so happy as they are in every respect, so rich in resources "of every description, having the use of excellent roads, will not "readily believe that important results here frequently depend upon "50 or 60 mules, more or less, or a few bundles of straw to feed them; "but the fact is so, notwithstanding their incredulity. I could not "find means of moving even a gun from Madrid."

Hampered with difficulties in procuring transport, the Duke was further subjected to repeated annoyances from the national antipathy of the Spaniard to the Portuguese. The Spanish muleteers, whom the Duke described to be "the lever of the Commissariat," refused, in 1811, to carry provisions for our Portuguese contingent. Not one of those men would willingly carry an ounce of food for the Portuguese soldiers, and had they known that the supplies on their mules were destined for the race they so heartily despised, they would have thrown down the loads, and driven away their animals in disgust. The feelings of these muleteers must, however, have been sorely aggravated by the tightness of the money market; the arrears of pay due to them owing to the want of money in the military chest were so considerable, that in July, 1812, the Duke reported that they had received no pay for 13 months.

Great difficulties were also experienced from the disgraceful conduct of our troops. In 1810, the Duke at Pero Negro refused to allow the convoys to be escorted, as the Spanish muleteers, who performed the greatest part of the transport service of the Army, would not submit to the brutal violence of drunken English soldiers, and would infallibly desert with their mules, if escorted by troops; and he expressed his belief that the delays which the drunkenness and irregularities of the troops would have occasioned in the arrival of the stores, and the loss by their own thieving, would have been found far greater than those experienced through any dishonesty of the muleteers.—(Letter to Horse Guards, November 2, 1810.)

Had a lesser authority than the great Duke recorded these incidents so discreditable to our national character, we should be incredulous as to their truth, but in 1810, he wrote as follows:—"A detachment "has scarcely ever gone as an escort with carts, even carrying treasure "or sick, that the soldiers have not taken bribes from the drivers to "be allowed to quit the convoy with their carts and bullocks. This "*practice* leads to fresh irregularities. To supply the deficiency of "transport, carts must be pressed, and to avoid this contingency the "country people will bribe the soldiers, so as to escape the infliction."

If then the difficulties which I have enumerated could be the results of want of regular transport in countries where we enjoyed the unusual advantages of numerous animals, extensive credit, and a friendly population, what might we not have anticipated under less favourable circumstances?

The armies which the French Republic poured into Holland, Italy, and towards the Rhine, found little difficulty in supporting themselves in the midst of plenty in such favoured regions. The rapid and successful movements of Bonaparte and the French generals opened up fresh countries with unlimited resources for the subsistence of their troops. Transport was not needed with tactics such as theirs. And in 1805 Napoleon proclaimed to the army advancing upon Ulm, that each General must provide for the subsistence of his troops, as no considerations of administration could enter into his plans. As war progressed, and the enormous armies then on foot became daily more dependent upon their administration, the Emperor Napoleon determined upon the formation of an organized Army Train. In his decree of 1807, he stigmatised as an absurdity the popular estimate of a contract as a lottery, whereby an honest contractor might be ruined, or become a millionaire, though idle and indifferent. "Military transport," he argued, "is as necessary to me as the Artillery Train, and should be as little "dependent upon chance."

With Napoleon, to speak and act were one. In the same year he raised the corps of *Equipages Militaires*, which in 1812, at the time of the Russian campaign had swelled to 22 battalions of 6 companies each. Napoleon calculated that 500 waggons should suffice for an army of 40,000 men, and he asserted that, with this number and the assistance of the regimental pack animals, and what the troops themselves could carry, he should experience no difficulty in providing himself with provisions for one month.

In 1813, a battalion of 10 companies was raised for special ambulance service; to each company one of hospital orderlies was attached. At the close of the great war, when reductions were compulsory, the *Equipages Militaires* were reduced to one squadron; but on the outbreak of war with Spain in 1813 (after all attempts to create a civil train had proved abortive), 22 brigades were hurriedly raised on a purely military footing, and dispatched into the field. Although imperfectly and crudely organized, yet manned and officered by French soldiers, they rendered efficient service; but on the declaration of peace in 1824, the French Government in their anxiety to avoid the errors of their predecessors, decided upon the retention of a small establishment, which should prove the principle or nucleus of a train capable of expansion to a war footing before war should actually break out.

The successful issue of the campaigns in Algeria may be attributed in great measure to the excellence of the transport arrangements introduced by Marshal Bugeaud. The French Generals proclaimed that the first and noblest mission of the train was to convey the sick and remove the wounded from the field of battle. To the caçolets and litters which accompanied the advancing columns, Marshal Bugeaud boasted that he owed his victories. While he stimulated the ardour of his troops, and urged them to renewed exertion, he inspired them with the confidence that the wounded would be the objects of his solicitude and care, and when the submission of the native tribes completed the triumph of his arms, he did not hesitate to assert, "Que le courage de nos soldats n'aurait pas suffi peut-être pour la "conquête de l'Algérie sans la possibilité de soustraire aux Arabes "nos blessés et nos malades."

The complete re-organization, and the final constitution of the *Equipages Militaires* were reserved for the present Emperor, who on the recommendation of Marshal St. Arnaud, established the service on its present footing.

When the Crimean war burst upon us, we were as unprepared for action, as ignorant of the necessities of the occasion, and of the requirements of an army in the field, as our allies were ripe and ready for the emergency. We dispatched from our shores, batteries of Artillery, regiments of Cavalry and Infantry, with companies of Engineers, and we flattered ourselves that we had sent forth an Army against our foe. Unfortunately we overlooked the services of transport and supply. The Train which should have been organized in anticipation of the struggle, and which should have accompanied our Army on its landing in Turkey, did not exist; it had been forgotten or neglected till it was too late. The Army arrived at Varna, and appealed to Omar Pasha for that assistance in waggons and pack animals, which they then discovered that they should require; 2,000 waggons and 1,200 mules were estimated as indispensable for our wants in Bulgaria, while, if the Army were to invade Russia, 14,000 animals would be required for our transport!

Such negligence, after the bitter experience of previous wars, is to this day inexplicable! It is difficult to credit that an English Army should have thrown itself upon an enemy's soil with no larger general transport than what some seventy animals and a few carts could supply, and that it should have risked destruction upon the chance of a successful foray upon the resources of a country in possession of the enemy! By the 18th September we had captured a few arabas, which were distributed among the divisions and Staff Officers according to the scale fixed by a general after-order of that date. With unconscious irony our available transport is described as "extremely limited," and in the partition of these few waggons, the wants of the supply departments were overlooked. The sequel to this improvident commencement is but too familiar to us all; but let us remember that the disasters entailed upon our Army were of our own seeking. The fabulous expenditure, into which we plunged in our futile efforts to extemporize a transport, was but the chastisement of our short-sighted economy during the past, and in the undisciplined rabble whom we hired into our service we read the lesson, that we had already been taught, but had forgotten, as to the necessity for training and organization.

30,000 men, 4,200 horses, and 180 guns, were landed at Old Fort without even the pretence of any transport for their supplies. A few mules for the conveyance of the first reserve of ammunition did accompany each division into the field, but the Army that could not have marched from Varna to the Danube, that could not have moved, as an Army should operate, beyond its own camp, was launched upon the Crimea without an ambulance for its sick, without, I may say, a vehicle for a bag of biscuit, or a waggon for its ammunition and tents. Misfortunes followed fast; sickness, disease, and famine, wrought havoc among man and animal—one calamity entailed another, each difficulty but suggested a fresh dilemma. Had there been roads, we wanted beasts, had there been beasts, we required forage; the absence of roads, destroyed the animals, while the want of men, made it impossible to repair the roads. In sight of plenty, famine reigned supreme. The Frenchmen lent us litters for our sick, and gave their men and waggons to convey our shot and shell, but gradually we succumbed to the self-imposed burthen, and our spasmodic efforts failed to extricate us from the mire.

On the 30th of September, 1854, 76 horses and mules composed the transport in charge of the Commissary-General. On the 16th of January, 1855, the returns showed a strength of 333 pack animals and 12 camels as the effective transport at his disposal; yet upon the termination of the war, we found ourselves with a Land Transport Corps and some 28,000 animals, 800 waggons, 1,100 carts, and 14,000 English and native drivers, indispensable adjuncts to our Army before Sebastopol.

And yet with this enormous throng of men and animals, and with the entire command of the sea, that our Army could have assumed the offensive, and have penetrated into Russia, with their base upon the Black Sea, I not only doubt, but am prepared to deny. *Our transport was valueless*, owing to the description of hired drivers and attendants of which it was composed. The leading periodicals of the day had encouraged the delusive idea that a transport could be extemporised, and that numerical strength was identical with the efficiency imparted by discipline and organization. With immature haste we hired into our service every available scoundrel in the East, we amassed thousands of animals and tons of equipment, and then attempted with a handful of men and Officers to reduce this rabble into a system, this mob into an organized establishment.

An Army cannot act upon the offensive until a base of operations shall have been secured. By us such base must be obtained by a descent upon some selected port or coast. From that base an Army cannot advance unless furnished with the means of transport, whereby the subsistence and supply of the troops are assured beyond the chance of failure. An English Army must land its transport with the troops; it cannot rely upon the advantages that a Continental power may possibly find at its disposal, but must anticipate all wants by a sufficiency of efficient transport. An Army unsupplied with such, is powerless both to advance or retreat; unable to secure the removal of the sick and wounded, such a force will be also unable to accept the advantages which defective strategy may present. With an efficient train it can be directed upon any point, it can be fed, clothed, armed, and recruited, and if compelled to retreat, can retire without loss or disorder.

Troops cannot live or fight without food or cartridges, and Lieut.-Colonel Reilly has reminded us that on many occasions the latter are of most importance. On one occasion in the Sikh campaign we were in imminent danger from a deficiency of ammunition; and in the Spanish-succession-war, 10,000 English troops were compelled to lay down their arms from a similar reason. When movements are rapid, engagements serious, and operations successful, the more dependent must be the General upon the ability of his transport to facilitate his measures and to co-operate with his advance.

The Land Transport Corps, which had been created in the spring and summer of 1855, was broken up on the conclusion of the war; and in the ensuing year, the Military Train was established as a permanent addition to our military force. We did not adopt the practice prevalent in Continental Armies, of placing the Train under the orders and at the disposal of the Officers responsible for supplies. It is true that at the period in question the supply services were not consolidated under one head, but it was not intended that the authority of the Commissary-General, which had previously been recognized, should be extended over the new corps. The Military Train was established, as it should be, on a military footing, but the principles of its organization were unsound. The Corps savoured too strongly of cavalry, and too little of the Train. Driving was a secondary consideration to drill, and the practical utility of a waggoner was lost in the trappings of a dragoon. Embodied as a purchase corps, into which Officers could exchange at their convenience, the Train became an attractive service to moneyed men, who could purchase promotion over their less wealthy brethren, and then leave the service for one more congenial to their tastes. Officers and men were not selected for a branch for which special qualifications and aptitude should have been required, while a general misunderstanding as to the duties and object of the service appeared to influence all ranks. Equipped and armed as cavalry, the train resented that they should be considered as carriers for the Army, but failed to define, to the satisfaction of others, what their legitimate duties were supposed to be. They were intended to be the "nucleus" of an Army transport; this sonorous term, which suggests much, is more theoretical than practical. This "nucleus" was to be so elastic, so expansive, that each troop was supposed to be capable of being developed into a battalion, each battalion into a division of disciplined transport, adequate to every want, and equal to all emergencies in time of war. But such hopes were not destined to be realized.

When it was decided in 1859 that an expedition should be dispatched to the North of China, to avenge our disaster on the Peiho, a battalion of the Military Train was sent out for service under the orders of the Deputy Commissary-General. This battalion was to form the basis of a Transport Corps, to be raised and organised on the spot, and in which the Officers, Non-commissioned Officers, and men of the Military Train should exercise command and superintendence, and should instruct the native drivers in the execution of their duty. It was proposed to raise a corps composed of 4,500 animals, horses, bullocks, mules, and ponies, with a proportion of four-wheeled waggons and Maltese carts, and 1,500 Chinese, Indians, and Manilla-men as attendants. Each private soldier of the Military Train would act as overseer or superintendent to some 30 animals and 10 native drivers, while the higher duties of command and discipline would devolve upon the Officers and Non-commissioned Officers of the Train. To Assistant Commissary-General Bailey, C.B., the organization and direction of this transport were confided by Lieut.-General Sir Hope Grant, in conformity with his opinion that the Commissariat should have unrestricted control over the transport.

The experience of a few months sufficed to convince the Commander of the Forces, that the removal of the Officer in command of the Military Train was indispensable to the creation of that feeling of co-operation and unity between the two branches of the service, which could alone ensure success. The officer in question resented the idea that he should serve in a subordinate capacity to one who was non-combatant. And in view of the danger of such misunderstandings, through which the service might have collapsed, the Commander of the Forces decided that he should be summarily relieved of his command. No further serious difficulties were experienced after the departure of this officer, but in addition to this transport, a corps of 3,000 coolies had been formed in the south of China, and arrived in the gulf of Pecheli with the troops. Two coolies would, between them, carry a hundred-weight, suspended from a bamboo upon their shoulders. Divided into companies and sections, under the command and direction of English Officers and soldiers, these coolies proved eminently useful, but their propensities to plunder and to loiter on the line of march, gave ample occupation to the Provost-Marshal and his assistants.

The campaign was brought to a satisfactory conclusion, and many may say, "all's well that ends well." But the experiment proved unfavourable to the "Military Train" as the motive power of an army. The opinions of Generals and Staff Officers were alike condemnatory of its organization, and all were impressed with the anomalous position which the Train held in its relations with the supply departments. If the Officers of the Train disliked or misunderstood their duties, the men were not likely to be zealous in the cause. They were well drilled and smart-looking, but they had never been taught how to pack an animal, or how to load a cart. The animals suffered while the attendants were indifferent to their wants, and the baggage was destroyed or damaged through the carelessness of those who should have superintended its conveyance.

In the ensuing year, on the expectation that the "Trent" difficulties would induce a war with America, troops were hurriedly despatched to Canada. A Commissary-General and the Commandant of the Military Train were sent out on the understanding that the whole transport of the Army was to be provided by the Train. On their arrival at Halifax however, the Commissary-General was requested by the General Officer Commanding, to make all the transport arrangements for the conveyance of the entire force, *including Military Train*, through New Brunswick to Canada, and to the various posts in Canada, to be reinforced. The whole arrangement had to be organized and set in motion in a few days, and it was carried out without one mishap, though the Commissariat staff in Officers and men for the whole of the duties, INCLUDING TRANSPORT, were actually fewer in number than the Military Train, destined for the performance of transport alone.* The secret of such success lay in unity of action. Transport money and supply were under one direction; and one head, an extremely long one, organized and carried out the arrangements for this long and perilous march. Command of money levelled all obstructions in his path, he created what he did not find at hand, he provided transport for every want, and eventually conveyed the very Train that was dispatched to Canada for the purpose of conveying him.

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* Memo. by Sir W. T. Power, K.C.B., Commissary General-in-Chief.

In the ensuing year, 1861, the difficulties in New Zealand entailed a war upon an extended scale. A force of 10,000 troops was despatched to that country, and Sir Duncan Cameron was appointed to the command. As usual, the transport had to be created—none was sent from England—and to the officer who had distinguished himself in this capacity in China, the duties of the formation and direction of this branch were committed.* The military stores at Auckland were not extensive or varied. Twelve pack-saddles and three sets of double harness can hardly be considered a comprehensive stock from which an efficient train could be equipped, had they even been of good material and workmanship. But unluckily the leather was rotten and the packs were valueless. The Director, however, rose superior to such difficulties. In time, under his superintendence, a transport establishment was organised, comprising 1,534 officers and men, 1,516 horses, and 728 bullocks. The Officers and men were transferred from the Line, and the Colonial Militia regiments. The carriages were two-wheeled, light town-drays, without springs, purchased at Sydney, and drawn by horses; while the bullocks were accommodated with drays of the same description, but of heavier build. The horses were procured from Tasmania and Australia, and all the pack animals were eventually provided with the Otago pack-saddle, which has proved immeasurably superior to every other description of pack-gear. Equally adapted for riding or pack-purposes, this saddle can sustain a heavy load, which neither slips nor galls the horses' backs, as all other patterns have been found to do. The service ambulance waggons, which were unsuitable for the country, were replaced by light American waggons purchased on the spot.

As the force advanced into the Waikato country, and the duties of the inland water transport devolved upon the Commissariat, when the Royal Navy were compelled to reinforce the troops, three companies of boatmen were at once raised and organized from colonial resources for this arduous and unexpected duty. Boats of special build and shape were constructed upon the diagonal principle, after the designs prepared by Mr. Bailey. They carried from 10 to 12 tons weight of cargo, in two feet of water, and were propelled by 16 oars or sweeps. This water transport proved of incalculable benefit; and as the entire duties of supply, both of food and transport, were conducted under one department, the two services were thus blended in harmonious action, which entailed regularity and ensured success.

In February, 1864, the fourth battalion of the Military Train arrived in New Zealand. It was arranged that it should undertake the transport duties at Auckland and the vicinity, while the remainder of the line, some 150 miles, should be served by the Commissariat Transport Corps. The importance of the duties entrusted respectively to the two departments can be estimated by this striking contrast in the limits of their operations; but the comparison of their relative responsibilities can better be appreciated by the observation that in Mr. Bailey's corps, each division of 210 animals was placed in charge of three Officers, while in the Military Train that same number was employed with each troop of some sixty horses.

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* Assistant Commissary-General Bailey, C.B.

Of the transport arrangements in Abyssinia I will not presume to speak, as the incidents of that campaign will form the subject of a lecture to be delivered shortly by a distinguished member of this Institution.

While it is impossible upon economical grounds to maintain in time of peace a military transport, available for every service of supply and conveyance, and adequate to the requirements of a large Army in the field, *the doctrine which would advocate extensive reliance upon purely local transport, hired or purchased at the seat of war, is, in my opinion, a dangerous delusion.*

If the enemy had but timely knowledge of our approach, the country would be promptly cleared of all descriptions of transport, as proved the case in China; as the Russians invariably attempt to do; and as the Austrians should have done in the war with Prussia. But on the presumption that native carts and animals could be obtained, could we secure efficient drivers and attendants? Could we *improvise* on the moment a system which should ensure punctuality and precision in the delivery of stores? From what sources could we obtain persons qualified to organize and reduce an undisciplined, perhaps unwilling, body of peasants, ignorant of our habits and impatient of control, into an efficient corps, divisible into detachments, under proper superintendence? What number of soldiers would not be required to keep guard over such rebellious servants, and to prevent the mutiny and desertion which have always characterized these levies; what amount of bayonets would not thereby be lost to the combatant portion of the Army; and of what use are untrained Non-commissioned Officers and men borrowed from regiments, when placed in charge of animals and drivers, whose characters and peculiarities they invariably misunderstand? Such a transport is little more than a miscellaneous mass of material, without vitality or cohesion.

Men, taken haphazard from regiments for a day's job, as Sir W. Power has observed, cannot be expected to comprehend or care to do all that is required. They have to get a disagreeable task done, and to return to camp—the most obvious means of accomplishing both, are to hurry the cattle and drivers by blows and threats. The necessary result ensues, the cattle are worn out and perish, the drivers desert, and the transport is destroyed.

Such hired transport never has yet given, and never will give, mobility to an Army. Regular Transport under military discipline, supplemented by an organized auxiliary train, can alone attain this end. When our regular Transport is to be expanded by the assistance of the best material we can obtain, *the auxiliary transport to be raised must be manned and officered by Englishmen.* From the regular

Transport Corps we shall obtain a proportion of Officers, Non-commissioned officers, and men, who will instill into the new levies those principles of discipline and subordination, with which they themselves are animated. This process of expansion must be set in motion on the first menace of approaching war, so that when hostilities do commence, we may find our transport already on a war footing, prepared for work, and commensurate with the requirements of the force which we propose to send into the field. We must no longer court disaster by sanguine expectations that transport will be procurable at the seat of war. Some animals may be obtained near our base, but *carriages and horses, and, above all, efficient English drivers, must be despatched from England, and should land with the forces on their arrival at the scene of operations.*[*]

The regular Transport Corps should be composed of men and Officers of unusual intelligence, and of special aptitude for the service. Highly trained and disciplined in time of peace, each Non-commissioned officer and driver *must* be qualified for superior rank in such auxiliary transport as may be levied at the time of war. No reliance can be placed upon hired native drivers or conductors, as the French discovered to their cost in the Crimea. Insensible to any feeling of honour, or of regard for the master whom they have engaged to serve, such civilians resent the restraint of discipline, and either abandon their charges or desert to the enemy. Expediency would also suggest another reason why an invading army should as much as possible abstain from interference with the local transport of the country. The supplies of forage and other necessaries for the troops can most easily be collected through the agency of contractors. The intervention of such people will be facilitated, if the transport of the country be left at their disposal, but all beneficial action on their part must be arrested, if the carts and animals in the district should be impressed into the service of the Army, and the peasantry be denuded of all means of conveyance.

As it is indispensable that regular transport should form a component part of every army in the field, so is it equally necessary that such transport should be organized and disciplined in time of peace, and be modelled upon a military footing. The results of past wars have convinced the great Continental Powers of the necessity of this precaution. Our Indian experience is also confirmatory of this view. Hired transport was denounced in 1800 by the Duke of Wellington, as "unsuited for light detachments, or, indeed, for any body of troops "which is obliged to move to any distance; and the expense which is "incurred affords no security that the troops will enjoy, in the moment "of need, the advantages of the stores and supplies for which the "carriage is provided."

As a further instance of the inefficiency of hired transport, I shall quote the letter of the Duke of Wellington to Lord Liverpool in explanation of the delay that had occurred in the investment of Ciudad Rodrigo:—

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[*] The miscarriage of Sir J. Craig's expedition, in 1805, was attributable to the want of efficient drivers.

"Gallegos, 7th January, 1812.
"After every allowance is made, we must expect disappointments when we have to deal with Spanish and Portuguese carters and "muleteers, and therefore I cannot invest the place until to-morrow.

"What do you think of empty carts taking two days to go ten "miles on a good road! After all, I am obliged to appear satisfied, "or they would all desert."

Such was the opinion entertained by the Duke as to the merits of the Spaniards and Portuguese, who are acknowledged to be the best muleteers in Europe or elsewhere.

In 1860, Sir Charles Napier thus expressed himself upon this question—"I am convinced that the baggage of an army can never "be rendered properly movable, even in Europe or America, still less "in India, unless it is formed into a corps perfectly organized. Such "a project applies to every country, every army, and every climate. "It is a general principle by which most difficulties regarding baggage "may be removed, and all of them reduced and made comparatively "trifling. The baggage of an army is perfectly susceptible of being "reduced to order, but for that purpose a rigid organization must be "established." He then proceeds to depict, in graphic language, the scene of turmoil and confusion which invariably occurred on the morning of the march. As it was in his time, so was it in the campaigns of Lord Strathnairn, who attributed the delays and difficulties he encountered in 1857 to the unorganized hired transport, with which his Army was supplied. He has described the confusion and embarrassment of the march, the waste of valuable property, the excesses and outrages of the ruffians who composed the train, and the dangers to which the communications, safety, credit, and discipline of his Army were continually exposed.

The control of the Transport should always be entrusted to the Officer who may be responsible for the supply of an Army in the field. It is obviously inexpedient that any division of authority over any branch of the service should exist, and experience has fully demonstrated that this principle is peculiarly applicable to the transport. The successful execution of the duties of supply are entirely dependent upon command of transport; if this command be withheld from the supply branches, it follows that responsibility cannot be exacted from them in case of failure. If the administrative departments are to be united under one head, and to that one person the duties of supply are to be confided, to him also must complete authority over that essentially administrative branch, the Transport, be unreservedly conceded. It may be easy to obtain the material for a train, but no one will manage it or husband it so well as the person who must look for his own success or failure in the manner in which that train is administered. Upon the recommendation of Lord Strathnairn's Committee, the direction of the whole of the Army transport is to be entrusted to the officer at the head of the administrative Staff of the Army, and to him will all requisitions for such transport as may be required for special services be addressed.

The principal duty of the Transport is for services connected with the supplies and stores of an army. While the entire Transport is maintained in one body, under one head, and proper portions of it are detached, as occasion may require, for each division or regiment of an army in the field, and which detachments upon the completion of this service will return and become available for other duties, it is clear that great economy of labour is secured, and the work is divided amongst the entire Corps. If on the other hand, fractional portions of the Transport are detached from the force, and are specially and permanently transferred to Divisions, Brigades, and Corps, it is evident that by such arrangement some portions of the Train will be overworked, whilst others for a long period remain inactive, and are practically useless. It is impossible to precise the exact amount of transport that any portion of an army will require, until the locality it may occupy, the nature of the roads, and the distance from the magazines shall have been taken into consideration. One Division may have more than it requires; another may be isolated, and not have sufficient; in one the Transport may be idle in the vicinity of the stores and magazines, in the other the animals may be worn out with fatigue, whereas, if the entire transport be under one officer, he would allot to the applicants a proportion equal to their wants, and as it might be required. With the exception of the Siege Train, which, as a component part of the Royal Artillery should be amply provided with special carriages and horses of sufficient size and power for the conveyance of its material, there should be no separate transport trains, as many Officers of the Royal Engineers have advocated. The horses and drivers for such duties require no special training, and the occasions for their employment are not so frequent as to call for separate establishments. A horse that will draw a bread-waggon will drag a pontoon carriage, and the Train soldier who can drive a store-van is equal to the responsibility of steering an Engineer's cart. Special carriages are indispensable, but they should be horsed and driven by the Train.

The time during which an army is in movement, will usually bear but a slight proportion to that spent in comparative inaction, during which it will not require transport for its munitions and material of war. Employment for the Train can, however, always be found under all circumstances by the Supply Departments, as food and forage are a daily and indispensable requirement. Stores must be accumulated, and a division of labour amongst the entire transport will reduce the strain imposed upon the animals, and expedite the service, while we should remember that the nearer to the magazines the Train is encamped, the greater will be the economy of labour in the consequent diminution of transport for its own provisions, forage, and material.

In Prussia, as we are informed by Lieutenant-Colonel Reilly, in his able memorandum on the war of 1866, military transport is arranged upon the principle, that every portion of the Army has its own transport. Be it a squadron, or a battalion, a brigade, or a division, each body is supplied with means of conveyance for their ammunition, baggage, clothing material, arms and accoutrements, food and forage, besides transport for a proportion of sick and wounded. In addition to this Corps Transport, the General Transport of the Army provides for the conveyance of forage, food, and fuel to and from the great depôts, where the Corps waggons are loaded for the conveyance of the sick and wounded on extraordinary occasions, and for the grand depôts of ammunition. The transport allotted to each department of the *Corps d'armée* from the Train is under the orders of its own Officers. The ammunition columns under Artillery Officers, the supplies under the Commissariat, the pontoons and bridges under the Engineers.

The entire Train is under the orders of the Intendant General, who is responsible for the efficiency of the whole.

These Prussian regulations are, however, but in keeping with their military system. With them each *Corps d'armée* is localized and affiliated with the Landwehr and Landsturm of that province, in which its head-quarters in time of peace will always be fixed, and from which province alone its entire reinforcements in men and animals will invariably be drawn in time of war. The theory of this arrangement appears to be unexceptionable, and would possibly work well in a campaign when troops are in movement, or when fighting is going on; but if any body of troops, so supplied with transport, should be detached from the main army in the field, and remain stationary in one spot, it is clear that a great portion of their train must remain inactive, and its services be then lost, useless as it is alike to this body of troops and to the main army, who might be longing for their assistance.

The description of transport to be used in a campaign must depend upon the natural features of the scene of operations—"*Chaque pays, chaque mode*," would be the principle that must determine the agency to be employed. Mules and elephants, boats and waggons, men and bullocks, carts and camels, are all equally useful and indispensable according to the exigencies of the situation. But it is of wheeled and pack transport alone that I now speak, as they alone can enter into consideration, when the subject of "regular transport" is entertained.

The demands upon the Transport Corps, as "the carriers of an army," include—

1. Conveyance of ammunition.
2. Conveyance of the sick and wounded and hospital stores.
3. Conveyance of all army equipment, stores, and supplies, as well as the more special services of Engineer, pontoon, bakery, and telegraph trains.

For these duties, carriages on two and four wheels, as well as pack-animals, will be required.

The waggons must be of two descriptions, for special and general duties.

The former of peculiar construction, adapted to the requirements of the special service for which they are needed; the latter of such shape or build as may enable them to carry the largest amount of general or miscellaneous stores, without danger to the load, or injury to the horses, and to be applicable to a variety of uses.

To ensure efficiency and durability, all carriages should be constructed of the best and most suitable material, after the most approved pattern, so as to combine lightness and strength, capacity and ease of draught.

Heretofore an inferior description of animal has been purchased for train purposes; but as waggons follow in the line of march on roads that have been cut up by Artillery and other troops, it is indispensable that the Train should be as well horsed as any other arm of the Service.

To the wheels especial attention must be paid. Wooden wheels with metal naves, of wrought-iron or gun-metal, should alone be used, until it shall have been ascertained that iron wheels can be constructed suitable for the service, as it is expected will prove the case.

The Equi-rotal system which presents undeniable advantages from the facility of exchange and unity of pattern, does not meet with that approval in this country, which I understand, at one time, they were disposed to accord to it in France.

The axle-arms should be made of one uniform size and pattern, so that the wheels might be interchangeable with those supplied to Field-Artillery.

All army carriages, with a few exceptions, should be fitted with springs, upon the triple grounds of increased facility of draught, protection to the load, and diminution of serious consequences to the carriage from the effects of concussion.

The four-wheeled carriages, to be drawn by four horses, should be of sufficient size and strength to carry 40 cwt.; although on active service a load of 30 cwt. should be the maximum that it would be advisable to place upon them. In European countries where good roads are general, great economy in animal power for transport service would be secured if four-wheeled army carriages were constructed so as to admit of three horses being worked abreast. It is calculated that by this arrangement, not only would fewer horses by one-fourth be required, but the entire length of train would be diminished by one-third, and a proportionate reduction in the numbers of the escort could be effected.

The carts for two horses should be fitted with axle-arms of the same pattern as those on the four-wheeled carriage, and should be equal to a load of 20 cwt. The maximum weight in field-service should not, however, exceed 15 cwt.

Poles should be used, and the waggons and carts should invariably be driven. The Prussians and Russians adopt this practice. The weight of the rider is distressing to the horse, and decreases his efficiency. A broken pole is easily repaired, as a spare one can be conveyed without difficulty. The drivers should assist in placing the loads on the waggons, and in removing them, and should be able to repair accidents.

The harness should be of the simplest pattern, but be composed of the best materials and of equal strength to that issued to the Artillery.

Upon good roads a carriage drawn by two animals will convey nearly three times the quantity that two pack animals can carry. To this increase of power must be added the economy in forage, which will be ensured by a diminution in the number of pack-animals.

A proportion of pack-transport must, however, always be maintained for service in any country where we may take the field, as such transport can easily be thrown on shore with troops, ready for immediate work, as was exemplified in our landing at Pehtang, in China.

It has been urged that where artillery can travel, wheeled transport can follow, and that consequently pack-animals should be dispensed with as being both inconvenient and expensive. But with this opinion I do not concur. Artillery covers the advance of troops, but does not always accompany them, and frequently is at considerable distance from the infantry who may be seriously engaged in ground whither wheeled-transport and artillery could not follow them. Pack-animals alone should be employed with troops when engaged, or when in front of the enemy, for the conveyance of regimental and reserve ammunition. Marshal Bugeaud condemned the employment of wheeled-transport except with the reserves. A defile or causeway may easily be blocked, and the advance of cavalry or artillery be delayed through the accident of a disabled carriage. Pack-animals create no such obstruction; they can accompany troops into the most broken or hilly ground—go under fire, and move upon the worst and narrowest roads, or across enclosures. They can always be at hand to bring up ammunition or to remove the wounded; and if a retreat becomes advisable, they can be dispersed over the country, and can retire over any ground upon any point, while the wheeled-transport is compelled to keep the roads, and incur the chance of being captured.

The disaster at Hohenlinden may be adduced as an instance of the inextricable confusion into which an army can be thrown, when their baggage-train may be compelled to retire upon narrow roads, which become hopelessly blocked in its endeavours to escape; and it has been said that the abandoned and broken-down baggage-waggons which encumbered the road between Brussels and Waterloo would, in the event of a reverse, have rendered our retreat almost impossible.

The pack-transport organized by the Duke of Wellington within the lines of Torres Vedras, furnished the only means by which he could have successfully pursued Massena over a country so exhausted in its resources as that which was abandoned by the French troops, while the Transport that accompanied the Austrians in 1866, when on the march, during their operations in the Tyrol, was entirely composed of pack-animals.

Selected animals should be detailed for the conveyance of ammunition and the ambulance stores. To each pack-animal a man should be detailed, when their services are required with the advance of an army. With those in the rear, two men to three animals, will be a correct estimate.

No pack-animal should be required to carry on inferior roads more than 160 lbs. of load, added to the weight of his saddle, some 43 lbs. It must be remembered that when troops halt, or receive a check, pack-animals can seldom be unloaded, and therefore do not experience that relief which is extended to animals in draught. It is questionable whether a pack-animal remaining stationary with its load upon its back does not suffer and undergo more fatigue during the halt, than if it were marching at an ordinary pace.

For convenience of carriage, all packages intended to be conveyed on packs should be made up in an oblong shape, and should not exceed 80 lbs. in gross weight. The use of barrels should be confined to the conveyance of liquids. Their shape presents great difficulties of carriage, and if opened, they are not again closed without extreme trouble. For this reason ammunition should invariably be packed in boxes, or in strong cases of wicker-work, covered with leather or stout canvas.

The Otago pattern pack-saddle has been pronounced by all competent judges to be superior to all other descriptions of saddle, both as to the facility with which it can be laden, and to the comfort with which it can be carried. Instances of sore-backs were unknown among the 400 pack-horses of the Transport Corps in New Zealand, and among the animals of the mountain-battery in Abyssinia. And as this saddle possesses the additional merit of being adapted for riding, it is not surprising that after such experimental trials, it should have been pronounced the best for any service.

The subject of hospital-carriages has been so ably and so exhaustively handled by Professor Longmore in his treatise upon Ambulances, that it would be presumptuous on my part to express an opinion upon the principle which should direct the construction and management of such conveyances. In the cause of humanity we must hail with the liveliest satisfaction the anxious care with which this subject has been considered by all nations; for to no better purpose could science have devoted her energies than to the discovery of the means by which the sufferings of the sick and wounded could most effectually be alleviated.

I will but observe that while the dhoolie and the stretcher (wheeled or portable) afford the best and easiest mode for conveyance of the wounded to the field-hospitals, I am convinced that the cacolet is the most uncomfortable and most difficult to manage. Cacolets must, of course, be employed with cavalry, as no option would otherwise be left than to abandon the wounded to the mercy and charity of the enemy.

I approach with diffidence the question of the principles which should direct the constitution of the new Transport Corps, but I would suggest that the men should be selected from volunteers from our regular forces, and from such civilians as may have been accustomed to the care of horses and to the use of carts and waggons. The Officers should be drawn from those that are best qualified of the existing train, and from such Officers of the Army as may be deemed eligible for the service. Hereafter all vacancies should be filled by the promotion of the most deserving Non-commissioned Officers of the Transport Corps. While the principle of purchase should not be admitted in this Corps, the pay should be higher than the present rate. As the Transport will now form a branch of the Administrative Services, it is evident that the pay of the soldiers of the Train must be assimilated to that of the other branches. In time of war, the duties of the train are exceptionally severe and arduous. In peace alone, can the Train be instructed in their duties, and if the labourer is to be worthy of his hire, the remuneration must be equivalent to the services we exact. No corps in our service should be more highly disciplined than the Transport, but drill must not be mistaken for discipline. Parade must not be confounded with preparatory training. The brightness of a buckle does not constitute efficiency, and in the smartness of appearance, real serviceable qualities may be overlooked. Rigid discipline must be enforced, but need not degenerate into the mere formalities of the drill serjeant.

The dress of men destined to act as waggoners and carriers for the Army should be loose, and free from all unnecessary encumbrances and accoutrements. While it should be soldierlike and neat, it must be appropriate to the duties of the Train; it must not embarrass the movements of the wearers, and must afford protection in the roughest weather. It would be better that, in time of peace, the soldiers of the Transport Corps should not be armed when employed on Transport duties. In time of war, a revolver would suffice for their defence, and could be carried in a waist-belt.

A small Park of Construction should, I think, form a branch of the Army Transport Corps. In this establishment, pattern carriages for transport purposes, could be built, and experiments be conducted. The wheelers, smiths, and collar-makers would be there instructed in their duties, and the material of the Train be inspected and repaired. The larger portion of the carriages that would be required for the service could be procured more economically from the trade, as necessity might dictate; but the models upon which the same should be constructed would be made under the superintendence of the Director of the Park, and a small staff of skilled assistants. It would be advisable that every Officer of the Transport Corps should undergo a course of instruction at this Park, from which he should not be relieved until he had become thoroughly conversant with the principles on which Army carriages should be constructed.

Lord Strathnairn's Committee has remarked that "the introduction of railway conveyance need not complicate the question of ordinary Military Transport." Railways may afford great facilities, but cannot enable any army to dispense with animal transport. Communication by rail may easily be intercepted, and no army could rely implicitly upon such means of conveyance in face of an energetic and unbeaten enemy. The memorandum by Lord Strathnairn upon this subject is conclusive as to the limited assistance that any General would derive from such a source. Invaluable at times, a railway might at other moments prove inoperative for good. Compelled by the movements of the enemy to abandon the line of rail, he must have recourse to animal transport, which may not be forthcoming to relieve him from his difficulties, if he were not fore-armed for the emergency. The General who may find himself in undisputed possession of a railway will undoubtedly enjoy great facilities in concentrating troops upon any point that he may select. But it is far easier to collect together by such agency an overwhelming force, than it is to feed it when so collected. Men are moved more easily than their supplies or stores. In 1866, when the Prussians advanced into Bohemia after the battle of Königgratz, they were compelled, from this very reason, to extend their front, and to disperse their troops over a line of some 60 miles.

It is necessary that a certain proportion of Officers and men in our Army should be instructed in the management of railway engines and material? A train might fall into our hands in time of war, and our soldiers, but too probably, would not be able to profit by the opportunity presented to them. The knack of fixing rails and laying points would be a valuable addition to our military instruction; and sufficient knowledge in the mere rudimentary portions of the engineer and plate-layer's duties, might prove of invaluable service in time of war.

In conclusion, I beg to offer to you my sincere thanks for the patience with which you have received and listened to my remarks. The subject of my lecture is too comprehensive for the limited time at my disposal. I have not ventured to weary you with figures and calculations as to the collection and distribution of the Transport that would be required for such armies as now take the field, but have endeavoured to present the subject to your notice under a more attractive form, whereby I might enlist your interests, and deprecate your disapprobation of my efforts.

LECTURE.

Friday, May 7th, 1869.

Lieut.-General SABINE, R.A., D.C.L., President of the Royal Society, in the Chair.

STORMS IN THE BRITISH ISLANDS, AND TELEGRAPHIC WEATHER INTELLIGENCE.

By Robert H. Scott, Esq., Director of the Meteorological Office.

We all know that these islands enjoy a climate which is very equable, and is far warmer than that which would be due to their geographical position in latitude. The causes of this circumstance are very various, but they do not form any portion of the subject of the present lecture. Among the effects of it we may count our great liability to storms, especially in the winter time. Even over the area of these islands, limited though that be, there are marked differences in respect to this particular between the east coasts of England and the Atlantic shores of Ireland and Scotland, where it is only in sheltered situations that trees will grow at all.

We are placed on a sort of debateable land, between a cold and a warm area, during the winter time. In January the iso-thermal of 32° runs nearly due north from Strasbourg, until it reaches the Arctic Circle, so that if we travel due eastwards from England the temperature we experience will fall much more rapidly than if we changed our position in a northerly direction. There may be said to be a constant tendency to atmospherical disturbance, resulting in storms, wherever great differences of temperature are observed in adjacent districts, whether these differences in the temperature of the air exist over land, or over the surface of the ocean.

The former condition is what is associated with many of our own winter storms. A difference of 20° is not unfrequently noticeable between the temperatures taken simultaneously at Valencia and Yarmouth; and as much as 30° has been observed between the thermometer readings made at the same hour in the east and west of France shortly before a serious storm has commenced.

The latter condition, that of differences of air-temperature over the sea, is what is associated with the dangerous storms met with off the south coast of Africa. The Royal Meteorological Institute of Holland has published several investigations bearing on this subject, and from these it appears that in rounding the Cape from the westward the chance of falling in with a storm increases to a maximum about the meridian of 20° E., and diminishes after that district is passed. This region is precisely that where the remarkable changes in sea-surface-temperature are observed. These changes arise from the meeting of the warm current from the Indian Ocean coming down the Mozambique Channel, with the cold south Polar current. A change of 19°·5 in the temperature of the sea has been observed within one hour in this locality.

It is not, however, with the theoretical origin of our storms that I have to deal to-day, so much as with their history once they have commenced, and with the means we possess of giving news of their approach to our shipping, and thus, to some extent, of averting the damage they might otherwise cause.

The first idea of giving intelligence of advancing storms is undoubtedly traceable to the fact that some of the most serious storms felt anywhere, the West India hurricanes, travel along definite tracks. When a hurricane is first observed, it is usually at one of the windward islands, such as St. Thomas, or Antigua. It then visits successively St. Domingo, the Bahamas, and the coast of the United States, and ultimately passes out to sea again after describing a rudely parabolic course. As soon as it is known that such a storm has reached the coast of America, where alone efficient telegraphic communication exists along its track, news can be sent in advance of it, and thus captains in distant ports can be warned to prepare for its coming.

Most of the storms which are felt in these islands come on us from the Atlantic, so that it is quite impossible for us to get intelligence that a storm has actually begun anywhere before it reaches our own coasts. Accordingly we are compelled to look for other signs, and in most cases, fortunately, there are such indications. To interpret these aright, is the task to which we must address ourselves.

The history of the system of storm-warnings, as carried out in this country, is briefly this. When the Meteorological Department of the Board of Trade was established in 1855 by Mr. Cardwell, Admiral FitzRoy, then a Captain, was appointed as its chief. He had all his life paid special attention to the study of weather, and accordingly when means were placed at his disposal for the study of the meteorology of the entire ocean, the object for which the office was originally established, and which still continues to form its most important sphere of action, he soon began to turn his attention to the investigation of the weather of our own coasts. This subject eventually attracted his own attention almost to the exclusion of anything else.

At the meeting of the British Association, held at Aberdeen in 1859, under the presidency of the late Prince Consort, the idea was started that the telegraphic system might be used for the purpose of collecting and transmitting intelligence of storms. This proposal was taken up warmly, and a Committee was appointed to organize a practicable system of operations. The loss of the "Royal Charter" off the coast of Anglesey on the 26th of October in that year, immediately after the Aberdeen meeting, added fuel to the flame. A very careful investigation was made in the office into all the circumstances of that storm, and the results were published as No. X of Meteorological Papers issued by the Board of Trade.

The British-Association-Committee met on several occasions, and ultimately they adopted certain resolutions, which, however, were very cautiously worded, and confined to the recommendation that a plan should be tried for the communication from one place to another of the *fact* of the existence of a storm.

About the same time, M. Le Verrier, the Director of the Observatoire Impérial in Paris wrote to the Astronomer Royal here, suggesting a scheme for international co-operation in the work. In this letter he said that the final result at which he aimed was to give notice of a storm as soon as it appeared on the coasts, and to transmit intelligence of it to the ports which it might visit.

You will see that no idea of prophecy was originally propounded.

Admiral FitzRoy was not content with this system, and he proceeded to substitute for it a plan of foretelling, or, as he called it, "forecasting," firstly, storms for three days in advance, and subsequently, weather for two days in advance.

In order to collect the information, he made arrangements with the Telegraph Companies to have observations made by certain of their clerks at stations distributed over these islands. Instruments were supplied to them for the purpose, and a reporting code, in cypher, was devised, which has scarcely required any modification since it was first proposed.

Admiral FitzRoy's warnings, as I have said, conveyed a distinct intimation that a gale from a definite point would probably blow within three days at the place where the signal was hoisted. The signals used by him were, as is well known, the drum and cone.

If the cone was hoisted in an erect position it indicated northerly winds; in an inverted position, southerly winds.

The drum indicated that the wind which would blow, would be likely to change its direction suddenly.

The system of storm warnings was commenced in February, 1861. The first forecasts of weather appeared in August of the same year. These latter were only published in the daily newspapers, and were not made known by means of signals.

Although some scientific authorities entertained serious doubts as to the utility of the system practised by the office, it went on without hindrance until after Admiral FitzRoy's death in April, 1865. Subsequent to this date, a Committee was appointed, at the request of the Board of Trade, by that Board, the Admiralty and the Royal Society, to enquire into the condition and working of the office, and this Committee reported strongly against the system as actually carried on. Finally the Royal Society, when requested by the Government to appoint a Committee to take the superintendence of the office, declined to undertake the issue of storm warnings, so that when, at the end of 1866, the office was handed over by the Board of Trade to that Committee, the warnings were suspended.

Soon after the circular suspending the warnings had been issued, memorials praying for their restitution were forwarded from several ports, and the question was repeatedly brought before Parliament. Ultimately, at the end of May, 1867, the Committee were requested by the Board of Trade to give some intelligence of storms, in such manner as they might think fit. This the Committee at once undertook to do, as soon as they should have completed the inspection of their stations, but stated that they would confine the intelligence sent to a communication that a storm or a serious atmospherical disturbance *existed* on some part of our coasts.

You will notice that the Committee thus expressed their readiness to give some information regarding storms, three months before the meeting of the British Association at Dundee, at which meeting very strong resolutions praying for the restitution of the Fitzroy system were adopted.

The present system was commenced in January, 1868, and I shall now proceed to describe it.

The stations from which reports are received are 42 in number, 18 of these are British, 13 on the Continent of Europe, and 1 is at Heart's Content, in Newfoundland.

The only serious change which has been made in the home stations of late, has been the substitution of Pembroke for Weymouth, in order to get additional information from the coast of the Irish Sea. Possibly some of the existing stations might with advantage be suppressed, in order to enable the office to establish stations on the north-west coasts of Ireland and Scotland, but as yet no steps have been taken to effect this change.

The foreign stations have all been organized by means of the co-operation of the French authorities, which is most freely given. Both M. Le Verrier, representing the Observatoire Impérial, and Captain Véron, on behalf of the Ministère de la Marine, have been most ready to do all that they can to render the service effective. The system of international telegraphy is carried on by means of an exchange of telegrams, and it is only just to the French to say that they interpret the terms of this exchange most liberally.

Our own stations are fairly well placed as regards their geographical position, but less so in respect to their local situation, as to their being sheltered by hills, &c. Thus, for instance, Greencastle, at the mouth of Lough Foyle, scarcely feels any of our gales, at least with their full force.

The only great scheme of improvement which has been proposed has been a very wild idea, viz.: to anchor vessels outside our coast, connected with the shore by telegraphic wires. This plan was seriously proposed by an eminent foreign Meteorologist, who is, however, it is almost needless to say, a landsman. We may very fairly wait, before we adopt it, until he has taught us how to moor a vessel in 1,000 fathom water.

The first thing to be done before the Committee could issue warnings was to inspect the stations, a duty which had never previously been undertaken. This was effected in 1867, and the least that can be said of it is, that it was most urgently needed.

The telegraphic clerks, many of them with the greatest desire to observe and report well, had never had any instruction in the way of placing their instruments correctly. The thermometer readings were in many instances absolutely useless, the instruments having been set up under the roofs of railway stations. In one place the wet bulb was found immersed in water. At the very next station, no water had been near it for three weeks, except when it rained, and by both reporters, readings purporting to be of dry and wet bulbs, were regularly sent up. One man did not know the points of the compass. In fact it would have been a simple impossibility for anyone to have drawn correct conclusions as to weather from the materials for the purpose which were at Admiral FitzRoy's disposal. No one but he could have done so much as he did with the chances so much against him.

The first inspection produced a very beneficial effect, and since the second was carried out last year, a great improvement has been noticeable in the reports.

The information received from these stations consists of observations taken at 8 a.m. daily, and in addition, barometrical readings taken at 6 p.m. on the previous evening, with a report of the prevalent weather and of the strongest wind experienced during the preceding 24 hours. By this means we attempt to get an idea of what passes during the day at the different stations. What we do get, is not very satisfactory, but it is better than nothing. However, some few of the most important stations send afternoon reports.

This system, after all, gives us very little information as to what really takes place, as you will see presently.

Between the hour at which messages must be sent off, so as to reach London before the office closes and the next morning, serious changes may occur. The giving notice of these, especially during night time, would involve considerable extra expense in payment to the reporters and to the clerks in the central office.

The supply of Sunday reports, the want of which causes a serious weekly break in our system of weather-study, could not be effected without the continuous attendance throughout that day of all the observers at their posts, and of a staff in London to discuss their reports. You cannot fix the hour at which weather-changes are to take place, and must, therefore, be always on the watch. If then intelligence received from the stations is to be afterwards communicated to the ports,—and unless this be done there is no use in collecting it,—we must have the telegraphists at the out-ports also in attendance during Sunday.

Before we leave the subject of collecting information, there is one point which deserves notice. It is this—that errors in telegraphy and discrepancies between the reports sent in, cause us most serious inconvenience, involving as they do frequent repetitions of the telegrams and subsequent correspondence, if the repetition fails to remove the doubt. In order to counteract the ill effects of this liability to error, check stations have been established, *e.g.*, the three on the south coast of Ireland, so that we are nearly sure to get a true account of any serious change which sets in there. Reports from isolated stations, such as Heart's Content, Corunna, and Skudesnaes, are comparatively of minor value, as we cannot place implicit reliance on them owing to our inability to check them.

Accordingly, you see that we are in a considerable difficulty about obtaining the materials on which our study of weather and issue of intelligence is to be based. Suggestions for the maintenance of a constant day and night watch on the west coast of Ireland, or for the receipt of reports from Archangel or Odessa, are simply impracticable, principally on the ground of expense.

Having thus discussed the collection of information respecting weather, we have next to treat of its distribution to the public. The signal adopted by the Committee, is the drum formerly used under Admiral FitzRoy's system, and it is hoisted at 100 stations on our coasts. The intelligence supplied, is simply an intimation that there is an atmospherical disturbance somewhere on the coast, but it does not convey any expression of opinion that that disturbance will result in a storm at the spot where the drum is hoisted. The message is in each case sent to such places as seem to the office likely to derive benefit from it, but the recipients of the news are left to draw their own conclusions as to whether a storm will probably reach them or not. The office, however, aids them in forming opinions as to weather by means of circulars and the Fishery Barometer Manual, which are liberally distributed, and also by the free loan to small ports, of fishery barometers, an assistance most readily afforded both by the Meteorological Office and the Royal National Lifeboat Institution.

The task thrown on sailors is not a very difficult one, as all these men are already well accustomed to form a judgment as to probable weather from their own unaided observations. The hoisting of the drum simply indicates to them that there is danger about, and that there is additional reason to be cautious.

The drum remains up for 36 hours at a time. This limitation does not mean that a storm will come on within that interval, but simply that within 36 hours the weather will probably have declared itself.

Every message ordering the drum to be hoisted, conveys the reason of that order being given. The message itself should be, and frequently is, posted up on the flagstaff where the drum is hoisted. In addition, the harbour authorities can, if they wish, obtain information as to previously existing weather from the daily weather report, a copy of which is supplied free of cost by post to any port which asks for it.

It is necessary, under the present system, that the facts of the disturbance should be made known to the people at the port. As, however, it would not be possible for every one to go to the flagstaff and read the telegram, Captain Toynbee, my colleague, has invented the semaphore, of which a model is exhibited. This shows at a glance the direction and force of the wind which is blowing, and also the locality where it is blowing. The apparatus has been on trial for about a year at Blackwall, by permission of the Trinity House; at Liverpool, by permission of the Mersey Dock Board and the Royal Mersey Yacht Club, and at North Shields by permission of the Corporation of that town. No definite conclusion as to its use has as yet been arrived at.

We now come to the practical utility of the present system. Admiral FitzRoy believed in the general transference of the whole body of the atmosphere from west to east, and although this is not strictly true, it is true that most of our storms make their first appearance in the west and travel to the east. We get our first intelligence from our own west coasts, and so we cannot often give news of the disturbance to that district before the wind reaches the force of a gale. These are, however, coasts where there is not much shipping. Intelligence can be given with much greater effect to the Irish and English Channels and to our own North Sea Coast. To take an instance by way of illustration:—A very severe northerly storm set in at Valencia at 7 a.m. on the 19th of March last. As soon as the news reached us, we telegraphed to Holyhead and Pembroke to send extra reports at once. The clerk at Pembroke replied at 1 o'clock, that the weather was then improving, but at 2.30 he telegraphed again to say that the gale was just beginning. It swept over the channel and the north of France during the night. In this case, then, we are able to determine exactly the rate at which the storm was travelling. As a proof of the general easterly motion of our storms, I may quote the account given by Herr von Freeden, of the Norddeutsche Seewarte in Hamburg, of the results of the telegraphic warning system which is carried on between that office and our own. Thirty-seven messages of actual gales were sent to Hamburg during the year 1868; 19 were followed by a gale, 9 by a strong wind, 6 by no change of weather, and, in three instances only, did the storm, and that an easterly one, exist before the warning reached the port. Professor Mohn, of the Meteorological Institute of Norway, has been receiving similar messages from London during the past winter, and although the direct cable to Norway is not yet laid down, and the messages are delayed seriously *en route*, he says, in a letter just received, "I cannot but say that I am very well satisfied "with the results obtained."

In order to give satisfactory warning of storms, we must know three things about them:—

I. The signs of their approach given by the instruments and by natural phenomena.

II. The direction of their advance.

III. The rate of their motion.

If any one of these important data are wanting, we are utterly at fault; and, as we must necessarily wait for some time before either of the two last-named elements can possibly be determined, it is obvious that unless we get a deeper insight into the general motions of the atmosphere than telegraphic reports from one district can give us, we shall not be able to do much in the way of judging of weather beforehand.

I have told you that most of our gales come on us from the westward. They do not all do so. That of Easter-day last, first showed itself on the day before, on the coast of Norway. Next morning at 8 a.m. it was blowing hard from N.E. at Scarborough. This wind travelled down the coast during the day, and at 4 a.m. on the Monday morning, H.M.S. "Ferret" was wrecked at Dover. This storm, therefore, did not come in from the west.

Again, if a storm is advancing very rapidly, it may come on us before we expect it. This was the case with the storm of August 22, 1868, of which I exhibit a diagram. On the afternoon of the 21st, at 2 p.m. there were no signs of its approach, and yet, at 8 a.m. next morning, a furious north gale was raging in the south of Ireland. News was sent to Liverpool at noon, some five or six hours before the storm actually reached the Mersey; but several vessels which went out during the day were caught and wrecked. Another instance of a gale travelling very quickly was that of February 12, 1869, of which I exhibit the records from the observatories. This storm did not pass over Valencia; it advanced on us from the W.S.W., was first felt at Penzance and Brest and moved up the Channel at a very great speed. It did a great deal of damage. At present we know of no certain principle by means of which such gales as these might have been foreseen. They must necessarily, as far as we know, have thrown astray any calculations or forecasts made for three or even two days in advance.

Having thus told you some of the difficulties which beset the study of weather, I shall now proceed to show you some of the scientific principles, by the help of which we hope to grapple with and overcome them.

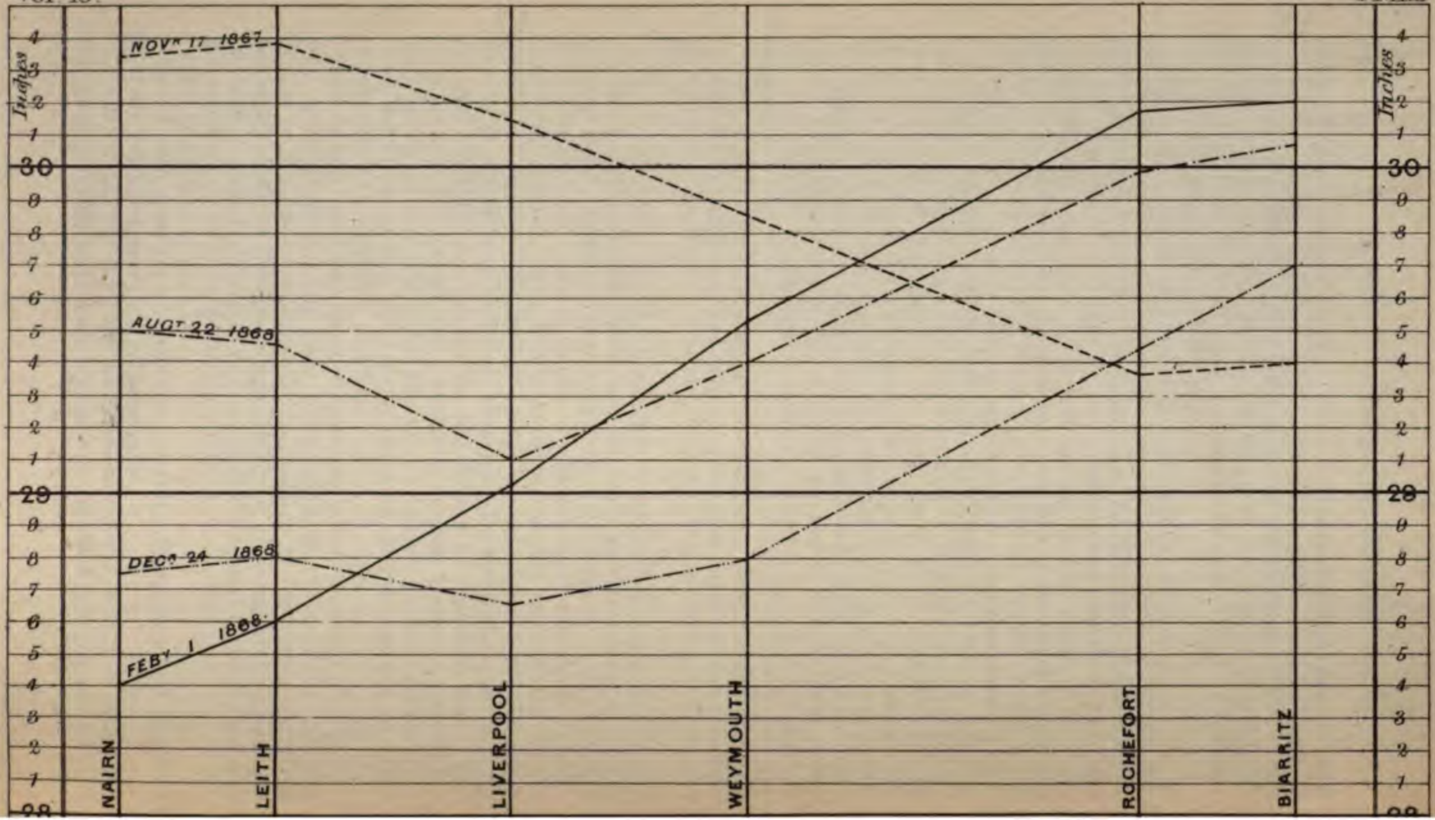
The former rules for the prediction of weather all depended on observations taken at a single station, without any reference to what the atmospherical conditions prevalent close by, might be. The old idea about barometrical indications was clearly shown by the words, "fair," "change," "storm," &c., which appeared on the scale of the instrument. These have long been known to be useless, and for them others have been substituted, which in their best form are those devised by Admiral FitzRoy, and placed on the fishery barometer-scales. The principles on which these rules are based are not, however, thoroughly satisfactory, as it is found that the knowledge of simultaneous observations taken at several stations is requisite to the drawing of right conclusions as to probable weather.

Among the most important steps made in the direction of satisfactory weather-study, has been the establishment of a law for the motion of the wind as referred to the readings of the barometer. This has been done by Professor Buys Ballot of Utrecht, but the principle of the law was established long ago by Redfield, and by Dr. Lloyd, the present Provost of Trinity College, Dublin.

The law is as follows:—

Stand with your back to the wind, and the barometer will be lower on your left-hand side than on your right.

Stated thus, the law has no predictive force, but, if it be stated conversely, it will bear such a meaning. On this law the weather in-


Inches
4
3
2
1
30
9
8
7
6
5
4
3
2
1
29
9
8
7
6
5
4
3
2
1
NOVR 17 1867
AUGT 22 1868
DECR 24 1868
FEBY 1 1868
NAIRN
LEITH
LIVERPOOL
WEYMOUTH
ROCHEFORT
BIARRITZ

telligence, which is issued in Holland, is based. An apparatus termed an aeroclinoscope, is used. This consists of a yard slung on a mast, and arranged so that it can be sloped at any definite angle, so as to correspond to any barometrical difference of reading observed in Holland on any day. The whole apparatus is moveable round a vertical axis, so that it can be placed in any azimuth to correspond with the direction in which the difference is observed. If then you face the instrument, and have the end which is lowest on your left hand side, you will have your back to the wind which will blow during the day. There are some difficulties in the way of using this instrument, and it has not been adopted here. However, the principle upon which it is based, is used extensively in our present system of weather telegraphy.

The first step taken when the Committee directed the study of weather to be commenced, was the drawing of daily maps. As soon as a sufficient number of these maps had accumulated, viz., for nine months, a regular examination of them was instituted, with the view of testing this law.* The first thing done was to determine the daily difference between simultaneous barometrical readings over a definite area, and compare with this difference the winds subsequently experienced. The limits taken were Nairn, Valencia, Rochefort, and Helder, forming a quadrilateral, of which the diagonals are about 600 miles in length. As a result we find that whenever the difference of barometrical readings exceeds 0.6 in. over this area, the chance is 7 to 3 that the wind will, before next morning, reach force 8 of the Beaufort-scale, at three stations within the area (this is what we call a storm), and that its direction will have been indicated correctly by the law.

On the other hand, the chance is 9 to 1 against any storm coming on which has not given signs of its approach by atmospherical disturbance, detected by barometrical readings at least some hours before.

The principle has proved a most useful one, as it is so eminently practical. We know from it, with very considerable certainty, what winds are likely to blow during the day, and, therefore, what is the danger most to be apprehended. It does *not* tell us how soon the storm will come, but it does tell us that if the readings in France are much higher than those in Scotland, there is no danger of an easterly gale.

The conditions of pressure which have been noticed on the occasions of several remarkable gales are represented on Plate xiii.

The horizontal scale is approximatively proportionate to the distance between the stations, the distance from Nairn to Leith being about 100 miles.

The actual barometrical readings, and the winds, with their force (Beaufort-Scale), observed in each case are as follows :—

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* The results of this enquiry have been printed by permission of the Committee.

	November 17, 1867.		February 1, 1868.	
	Barometer.	Wind.	Barometer.	Wind.
Nairn	30.33	W.N.W.$_1$	28.40	N.W.$_3$
Leith	30.38	N.E.$_3$	28.58	S.W.$_7$
Liverpool	30.14	E.N.E.$_8$ (Holyhead)	29.03	W.$_8$
Weymouth	29.84	N.E.$_9$	29.52	S.W.$_8$
Rochefort	29.37	N.W.$_2$	30.16	S.W.$_5$
Biarritz	29.41	S.E.$_1$	30.20	S.E.$_1$

	August 22, 1868.		December 24, 1868.	
	Barometer.	Wind.	Barometer.	Wind.
Nairn	29.50	E.N.E.$_1$	28.75	S.S.W.$_1$
Leith	29.46	S.S.E.$_4$	28.79	S.E.$_1$
Liverpool	29.10	S.S.E.$_8$ (Holyhead)	28.65	S.E.$_2$
Weymouth	29.42	S.W.$_9$	28.81	W.N.W.$_5$
Rochefort	29.96	W$_5$	29.44	W.S.W.$_9$
Biarritz	30.07	N.W.$_4$	29.71	S.W.$_9$

It will thus be seen that the directions of the wind required by the law were strictly observed in each case. Its force will be seen to depend on the difference of readings between the stations. Thus, the gale on the 24th of December was not felt at any British station, although the barometrical readings at all our stations were below 29 inches. The only district in which the gale was observed was in France, where readings were much higher than they were here, thus producing a considerable barometrical difference.

As an instance of the use made of the principle, I may cite the system of telegraphy carried on with the Underwriters' Association of Liverpool. Whenever the difference of readings over the area already referred to exceeds 0·5 in., a special telegram is sent to the Underwriters' rooms. By this means the subscribers gain intelligence before the disturbance becomes serious. They continue to receive daily messages, until atmospherical equilibrium is again restored, and are thus kept informed of what is going on about them. The system of warning telegraphy carried on with Holland, Hamburg, and Norway is conducted on similar principles. A message is sent whenever there is a certain amount of disturbance of pressure, without reference to the fact of a gale having commenced or not.

This system, however, only tells us in general terms that there is a chance of a storm, but does not say exactly where it will blow hardest. In order to localize the indications, we proceeded to triangulate the area of our observations, as if we were surveying, and to calculate the daily barometrical differences along all the lines thus obtained. These barometrical differences were all reduced by means of factors to gradients per 100 miles, and it was found that, assuming a gradient of 0·12 in. as a sign of danger, the average chance, for all points of the compass, for a wind of force 8 to succeed such a gradient, was about 6 to 4. The south-west winds were more certain to follow the indications than the others. North-west winds were peculiarly liable to "back."

Now, with this principle well in our minds, let us proceed to see how it may be applied. The first sign of an approaching storm is usually a decrease of pressure in the west of Ireland. This produces a gradient sloping in a direction from E. to W., and indicating a southerly wind, which you all well know is the usual commencement of a storm. Now, if we find that pressure is falling fast at Valencia, and that at Greencastle and the Scotch stations it is following suit, while readings at Rochefort continue high, we feel sure that the wind will veer to W., and probably to N.W., in which latter case, pressure at Valencia will recover quickly. If, however, the fall at Valencia is followed by a rapid fall at Penzance, while northern stations remain unaffected, it is probable that we shall have north-easterly winds in the north of England, and on the east coast.

Before an east wind can blow, the pressure in France must be much less than in Great Britain. This condition may be produced either by a barometrical depression travelling across France, while our readings remain high (this motion is usually from the westward), or else by a local depression being actually formed in France, a case which sometimes seems to occur, but of which we know very little.

This law of Buys Ballot's throws some light on the probable motion of the air, once a disturbance has definitely formed itself; but it does not aid us in forming an opinion as to the changes which may be in progress outside the limits of the area covered by our observations, and thus to foresee what is coming on.

In order to do this, we must carefully examine the atmospherical conditions which have preceded most of our great storms, and see whether we are able to discover any similarity between them, which would in any way enable us to detect even a suspicion of a relation of cause and effect between these conditions, and the storms which followed.

The entry of the observations on daily charts was a great help to this study, as such graphical representations are easily compared with each other.

The first fact of interest which showed itself, was that in certain instances a similar succession of weather seemed to reappear. Thus two of the diagrams exhibited, form part of a series of ten days which recurred in December last, after having been noticed in the previous January. This is extremely interesting, though it is only what any one who has watched the weather carefully for any considerable time would be led to expect. In saying this, I must not be taken as asserting that there is any proved periodicity in these phases of weather. When a fact like this has to be established, its advocates have usually to strain a great many points. Thus recently it has been attempted to establish the periodicity of the Royal Charter gale at the end of October. In order to do this, every gale which has been registered in the month of October for many years past has been pressed into the service; thereby several that were merely equinoctial gales, and were therefore due a full month before the period to which they were referred, have been quoted in confirmation of the theory.

Among the instances of recurrence which have been noticed, that already referred to, merits special attention, and I shall now proceed to describe it. On the 22nd of January, 1868, very remarkable atmospherical conditions appeared. There was a strong W. gale in France, with easterly winds over the north of England, a barometrical depression existed between the two currents, and a thick fog was felt in London. This was succeeded on the 23rd by a rapid rise in pressure with northerly winds, and before daylight on the 24th a tremendous southerly storm burst upon Scotland, and did immense damage. The same conditions as on January 22, re-appeared on the 8th December last, and were followed after the same interval by a similar southerly storm, though one not quite so serious as that which had occurred eleven months previously. This set us all to work in the office to examine all cases in which similar atmospherical conditions were noticeable, and several instances of these were discovered. These conditions are the co-existence of the two great currents of air, the Equatorial and Polar currents, at the earth's surface, the latter lying on the polar side of the former. This relation of the currents to each other has long been noticed by Mr. Meldrum, the Secretary of the Meteorological Society of the Mauritius, as preceding the commencement of the cyclones in the Indian Ocean. He says in a recent paper published in the Journal of the British Meteorological Society, that these cyclones *invariably* arise between two such currents when the barometer begins to fall.

Whenever we have noticed the existence of these remarkable conditions, a southerly gale, or at least a fresh southerly wind is nearly sure to occur within the area of these islands within about 48 hours. Out of 24 cases examined, 12 were followed by such gales after 48 hours, 4 by gales immediately, 7 by fresh southerly winds, and 1 was a failure. This is very satisfactory, as it may perhaps lead us to useful results hereafter.

In order to work out this or any other question in meteorology, we want abundance of materials in the way of observations, and those too of a very high character. I have already explained to you, that we really gain very little information as to weather from our telegraphic stations, as very few observations are made there in each day. The scheme of land-observations suggested some years ago by the Royal Society, and at present carried out by the Committee of the Meteorological Office is calculated to render good service in this respect. The original object for which this scheme was first promulgated, was the determination of the various meteorological elements for these islands in a way independent of eye observations, by means of continuously self-recording instruments. The instruments employed are a barograph and thermograph which register themselves by means of photography (these instruments have been brought to their present state of perfection mainly by the efforts of the staff of the Kew Observatory); and the well-known anemograph invented by Dr. Robinson, which records itself mechanically. Messrs. Beck, of Cornhill, have kindly allowed me to exhibit a complete set of these instruments, and I shall be happy to explain their construction after the lecture to any one who may wish to see them.

The records, however, are quite continuous, and I exhibit a diagram showing a barometrical oscillation which passed over these islands within 24 hours, and also a curve showing a remarkable instability of pressure. You will at once see how perfectly impossible it would be to attempt to obtain a record of such phenomena from eye observations, such as those used for the Daily Weather Reports.

The stations at which these instruments are erected are 7 in number, and have been selected with reference to their geographical position. There are 3 of them in England; Kew, the central one, under my colleague, Dr. Balfour Stewart, who undertakes the entire supervision of all the observations; Falmouth; and Stonyhurst. Two are in Ireland, Armagh and Valencia, and two in Scotland, Glasgow and Aberdeen. Another station in the extreme north of Scotland is most urgently needed, but there are as yet no funds to support it.

As an illustration of what these observations can yield, I exhibit as I have before said, the curves from the storm of February 12, 1869.

There is, however, one serious difficulty which meets us when we discuss land-observations, however accurate they may be. This is that the wind does not blow *true*, as regards either force or direction, inland as compared with observations made at sea. The observatories on the coast, such as Valencia and Falmouth, register much more wind than those inland like Kew and Stonyhurst. As regards direction, the lie of the country, and even the distribution of the woods has a tendency to produce irregularities and eddies. This serious defect can only be eliminated by increasing the number of points of observation, and we hope that private observers will come forward and help to complete our scheme for investigating the meteorology of these kingdoms.

After all, it is mainly to the observers at sea that we must look for our records of wind, and especially to sailing ships. These islands are a mere speck on the surface of the globe, and the weather we experience is only the result of changes which affect immense areas. For information as to these changes we must look to the sea: the observations made on shore, accurate though they are, are affected by so many disturbing causes, that there is always a difficulty in dealing with them.

The Meteorological Office has been established mainly for the investigation of Marine Meteorology, and it is to Officers in the Navy and in the Merchant service that it must look for the most efficient aid in the collection of new materials. The Office is always prepared to lend instruments to gentlemen who will undertake to observe with them regularly, but the main object we have in view is the quality, not the quantity of the information contained in the register; observations carefully made and accurately recorded, are the first and most important requisite towards the investigation of the laws of our storms, and the issue of satisfactory telegraphic weather intelligence.

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LECTURE.

Friday, March 19th, 1869.

General Sir WILLIAM J. CODRINGTON, G.C.B., in the Chair.

SUMMARY OF THE EXPERIMENTS AT SHOEBURYNESS DURING THE YEAR 1868–9.

By S. J. Mackie, Assoc. Inst. C.E.

It would hardly suffice in a *résumé*, such as I am now attempting, to follow the experiments seriatim, in the order of their dates, but it will be preferable to classify them into groups of subjects, so that the sequence of the results may be the better understood and comprehended. These sections, then, will be:—

I, Heavy Artillery; II, Ammunition; III, Field Artillery; IV, Iron and other Defences; V, Chemical and Incidental.

The tendency of gun-manufacture has been in the direction of larger and more powerful rifled-guns, and with the accomplishment of successively enlarged designs, has increased the difficulty and delay in moving and training these increasingly ponderous, offensive machines. The 9-inch gun is perhaps the largest that as yet can be satisfactorily worked with sufficient rapidity; with guns above that capacity, the great force of the recoil from the enormous charges of powder used, and the momentum of such masses of metal thus put in motion, had become elements of extreme difficulty. The necessity for carefully protecting these costly guns and their stores, as well as the specially trained men detached for serving them in action, has caused the smallest possible dimensions of port-hole to be most in favour, notwithstanding that the small-port-system does incur difficulties in sighting, and the absolute necessity for bodily lifting or lowering the gun in working and training. The enormous power of modern artillery has demanded shields and casemates of iron of a resistive capacity unheard of up to the present day. Mechanical skill has thus been necessarily required to aid both practical works of offence and defence; whilst the accuracy of fire has become too precise to permit any longer of open embrasures in the earthworks or masonry of ordinary fortifications. The value of chemistry, too, has been recognised in tests of the condition of stores, signal lights, and new and most powerful explosive-compounds. Such are only the main elements of the 40 days of experimental labour, and of the 220 separate sets of experiments which I have to reduce to order and pass under review within the one hour allowed me here to-day.

I pass then at once to the heavy artillery practice and trials, with the carriages of various natures tested in connection therewith; the means adopted for overcoming recoil; the mechanical appliances produced to facilitate convenience and rapidity of handling, in fact all that is immediately connected with heavy guns, assuming the 9-inch 12-ton Woolwich gun adopted into the service, as being the previous general limit of heavy rifled ordnance.

I.—Heavy Artillery.

§ 1. *Guns.*

The 10-inch rifled muzzle-loading Woolwich gun was tried on the 15th February. Its length over all is 15 feet 4 inches; of bore 145·75 inches; rifling seven grooves 1·5inch wide and 0·22 inch deep, spiral, one turn in 100 calibres at breech, increasing to one in 40 at the muzzle. Its weight is 18 tons 2 qrs. 4 lbs., and the breach preponderance 1 cwt. 2 qrs. 10 lbs. The practice was made at three degrees elevation, with eleven rounds of Palliser shot, 1·25 ogival head, and 400 lbs. weight; with ten Palliser shells, 1·5 ogival head, weighing, empty, 390 lbs., and containing bursting charge of 10 lbs., making a total weight of 400 lbs.; and with ten common shells, 1·5 heads, weighing, empty, 368 lbs., and containing bursting charge of 32 lbs. = 400 lbs. The charge for the gun used with the shot was 60 lbs. l. g. r. powder; for the Palliser shells 64 lbs. of pellet powder; for the common shells 40 lbs. l. g. r. powder. The results of the practice were excellent. With the shot, the range was from 1,592 yards to 1,725 yards, the deflection, all to right, from 3·6 yards to 8·4 yards. With the Palliser shells, the range was from 1,651 to 1,778 yards, time of flight from 4·4 to 4·7 seconds, and the deflection, all to the right, from 1 yard to 5·6 yards. With the common shells, range from 1,295 to 1,396 yards, time of flight from 3·8 to 4·1 seconds, deflection to the right 0·4 to 3·2 yards. The gun was worked by a detachment of one sergeant and fourteen gunners. Further practice was made with this gun on the 5th of March.

On the same day (15th February) trials for range and accuracy of a 12-inch rifled muzzle-loading Woolwich gun, of the jacketed pattern, were begun. The dimensions of this gun are:—length, 12 feet 1 inch; rifling 127 inches, with 9 grooves 1·5 broad and 0·2 inch deep, the spiral increasing from one turn in 100 calibres to one in 50 at the muzzle. Weight 23 tons 6 cwt. 1 qr. 26 lbs.; no preponderance at the breech. The practice was made with 600-pounder Palliser shells, with charges of 70 lbs. of pellet-powder. The flight of the projectile at 10 degrees of elevation of gun, was 12·5 to 12·6 seconds.

Further testing of this 12-inch gun was made on the 5th December, the wrought iron carriage and platform being mounted on C racers. This carriage and platform are part of the supply for Malta. The shot used in the practice, were Palliser-cored of 600 lbs.; the gun charges 70 lbs. r. l. g. powder. The tide having covered the foreshore, the exact range and accuracy of the shot could not be obtained, but the practise made in two rounds at a floating target about 1,800 yards distant, was very good.

An 11-inch bore muzzle-loading rifled wrought-iron 530-pounder gun was also tried in September. Weight 22 tons 3 cwt. 2 qrs.; breech preponderance 14 cwt. 1 qr. 8 lbs., length of bore 145·0 inches, over all, 180·0 inches; rifling, Woolwich system, rounded groove, spiral increasing from one turn in 100 calibres to one turn in 45 calibres at muzzle, seven grooves, width 1·50 inch, depth 0·22 inch, length 120 inches. It was decided to use pellet-powder in this trial, and the first step, therefore, was to ascertain the proper equivalent charge to 50 lbs. and 70 lbs. of l. g. r. powder. After firing the 17 rounds, and taking the initial velocities, it was decided that 54 lbs. and 78 lbs. were the equivalents respectively of the service and battering charges. The trial for range and accuracy was begun with common shells, 1·5 diameter ogival heads of the mean weight, empty, of 489 lbs., bursting charge 40 lbs., total 529 lbs.; length 37·6 inches, windage 0·08 inch. The range got with 54 lbs. charges, at 3 degrees elevation, was from 1,189 to 1,232 yards, the shells proving very unsteady in flight. Increased charges of 65 lbs. were fired, to see if the shells would prove steadier at a higher velocity; 1,410 yards were attained, but no improvement in the steadiness of the projectile. Next, a Palliser-cored-shot, 1·25 diameter ogival head, mean weight 534½ lbs., length 26·2 inches, was fired. At 3 degrees elevation the practice made with 78 lbs. powder, was from 1,570 to 1,673 yards.

I now come, in the sequence of events, to the system of conversion and construction of compound guns proposed by Mr. Parsons. And in describing that gentleman's plan, I shall endeavour to express his views as accurately as possible, and this will be the more just to him, because individually I am adverse to any conversion of cast-iron guns at all, although I have no desire whatever to do other than recognize the merits of Mr. Parsons' plan in respect to the construction of new weapons.

Mr. Parsons' attention was directed to the subject about the year 1858-9, when great efforts were being made by the Government to utilize, as it has been commonly termed, the cast-iron service guns, by strengthening them with external hoops of wrought-iron. Mr. Parsons formed the conclusion that this plan was the reverse of what theory indicated, if two metals possessing different degrees of elasticity and extensibility were to be combined effectually, and he consequently proposed his system of strengthening cast-iron guns by lining them with wrought-iron or steel-tubes, submitting this plan in May, 1860, to the Government. He then proposed to bore out the gun cylindrically, or slightly conical, and to force into it, by mechanical pressure, a tube of wrought-iron, or steel, turned accurately to fit the interior of the cast-iron casing. A drawing of a 68-pounder, lined with wrought-iron or steel tube, was sent to the Secretary of State for War at that date.

Mr. Parsons' argument was this :—

It is the interior of the gun that sustains the greatest shock; if this is of cast-iron, it is strained beyond its elastic limit before the strength of the hoops comes into play, but if the interior is of wrought-iron, steel, or homogeneous metal, it will stretch before breaking, but the stretching consumes a large portion of the force, and the remainder only is transmitted to the cast-iron, and is imparted to it in a less sudden and equable manner; the cast-iron, in fact, has only to do surplus duty. Another important feature in this system is that the longitudinal strength of the gun is not impaired as it is when the breech is turned down to receive external hoops. Mr. Parsons, after this, applied for a patent in 1860 for the use of a second, or B-tube, surrounding the A-tube, and in some cases, for very large guns, he proposed to use a third tube, surrounding the second, or B-tube, the lining tube thus built up being inserted into the cast-iron casing, as before. In 1861 the Ordnance Select Committee had a 68-pounder strengthened on the plan proposed by Mr. Parsons, but the inventor was not employed to carry it out, and the work was not, in consequence, done so effectually as it would have been, had he been consulted. The tube was bored out of a solid block of wrought-iron, which method he did not approve, and the thickness of the tube he proposed was about one-third more in proportion to the calibre than the one employed. Nevertheless, the Ordnance Select Committee report of this gun that "it endured 71 rounds proof series," *i.e.*, with a charge of 16 lbs. and shot of 68 lbs. increased every ten rounds by its own weight, the weight of the shot at the 71st round being 476 lbs., "that this exceeds in endurance all but one of the 68-pounders ever "tested, and all the 68-pounders strengthened externally by hoops." A second gun on Mr. Parsons' plan, a 32-pounder lined with a coiled wrought-iron tube, was tested in 1862, and the Ordnance Select Committee report "this gun endured 74 rounds (proof series), the unit "charge being 10 lbs. powder and a shot of 31·5 lbs.; this gun "did not burst, but the lining tube became flawed."

In June, 1862, Mr. Parsons patented an improved plan of inserting the tube into the gun, the object being to obtain a tube of larger diameter at the breech-end than would admit of being passed through the muzzle, he having become convinced that to retain a calibre suited to the weight of gun, sufficient strength to make the guns efficient rifles could only be obtained by this increased diameter. This he effected by boring out the gun from its breech-end, and inserting a reinforced tube through the breech and securing it in the gun by a breech-screw, screwed in behind it.

This method of inserting the tube from the breech end was submitted to the War Office in 1863, but was not accepted by the Ordnance Select Committee. The year following, a 30-pounder gun was converted by the French Government into a 6·5-inch rifled 100-pounder of 64 cwt., and tested at Gâvre. It fired 510 rounds, with 8·82 lbs. powder, and 69·43 lbs. shot, and 500 rounds with 16·54 lbs. powder, and 100·22 lbs. shot, in all 1,010 rounds, the gun still being serviceable. Subsequently it was fired with 26½ lbs. powder, and cylinders of 132 lbs. At the 1,021st round, it split in the chase, the breech re-inforce and breech-screw remaining perfectly sound.

After this, Major Palliser's plan of conversion received attention from the authorities, and it was not until the end of 1867, on the motion of Lord Elcho in the House of Commons, and the compliance of the Secretary of State for War, that Mr. Parsons' strengthened gun again appears upon the scene.

This gun, ordered in November, 1867, was delivered in August, 1868, and tried at Shoeburyness on the 10th September. The inventor had challenged to fire it with 30lb. charges, and 150lb. projectiles; and he boldly put the vent in the service position. The gun was proved at Woolwich with two rounds of 37½lbs. powder, and 150lb. shot, a rather stronger dose than the inventor anticipated, and which, as he believes now, overstrained the gun, and diminished its ultimate endurance. It, however, endured 163 more rounds, with charges of 30lbs. of powder and 150lbs. shot, when the outside-casing cracked, and on inspection, the B-tube was also found to have split, but the A-tube was sound and serviceable.

The gun was rifled with three raised ribs, having a uniform spiral of 1 turn in 30 calibres or 20 feet; the vent was placed 8 inches from the end of the bore. This rapid rate of twist gave a high amount of spin, whilst the cartridge being ignited near the middle, imparted to the projectile a very high velocity, and the ranges consequently attained by this gun were very long, surpassing, I believe, those of the service guns at corresponding elevations.

The mean ranges were :—At 1° 20′, shot 932 yards, shell 912 yards: at 3° 10′, shot 1,921 yards, shell 1,965 yards; at 5° 7′, shot 2,792 yards, shell 2,826 yards; at 7° 5′, shot 3,538 yards, shell 3,667 yards; at 9° 4′, shot 4.232 yards, shell 4,381 yards; at 19° 3′, shot 6,715 yards, shell 7,092; the longest range attained at 19° 3′ being 7,300 yards.

The weight of this 64-pounder gun as converted, is 103 cwt., calibre 8 inches, length of bore 131 inches.

When it is considered that this gun is of the same calibre as the service guns of 9 tons weight, made entirely of wrought iron and steel, and that it has fired continuously the full battering charges of those guns, the endurance exhibited is extraordinary; perhaps, however, the most valuable feature that the system, by this experiment appears to possess, is, freedom from explosive bursting. There is no instance, so far as I know, on record, of any gun firing continuously such heavy charges in proportion to its weight.

This gun yielded harmlessly. Its failing was indicated clearly by an external sign to those around, and their safety thereby secured.

Mr. Parsons considers this not the effect of accident, but that the same result must follow as a consequence, so long as the two materials used, retain their respective qualities.

It is known that good mild steel will stretch from 15 to 20 per cent. of its length, before it breaks, and 5 per cent. before its tenacity is impaired; but the very finest cast iron will not stretch 5 per cent. It is evident, therefore, that if the whole structure is of sufficient strength to resist bursting explosively at the proof, it can only afterwards fail by the gradual stretching of the inner tube, and that long before it has gone to a dangerous extent, it must split open the cast iron casing.

Next follows a most important weapon—the Whitworth gun.

The Whitworth 9-inch rifled muzzle-loading steel gun is, in fact, a 310-pounder. Its weight is 14 tons 8 cwt., the breech preponderance 6½ cwt. 20 lbs.; length over all, 163·80 inches; of bore, 140·06 inches; calibre major axis, 9·025 inches; minor axis, 8·250 inches; rifling Whitworth's hexagonal, spiral, uniform, one turn in 171 inches. The vent horizontal, through the cascable in line of axis of the gun, the hole being covered with a metal tube-catcher for naval service. The construction is on the built-up system, the inner tube being of Firth's steel, the same as in the Woolwich guns. This is covered over by a second steel tube, over the rear portion of which is a steel jacket. Over this again are two jackets of Whitworth metal, or steel compressed by hydraulic pressure. The shape of the gun is good, and the metal so far has acted up thoroughly to the heavy duty required of it. The first practice was made on the 15th and 16th September.

After firing seven rounds, it was tested by Mr. Whitworth's machine (which gauges to the $\frac{1}{10000}$th part of an inch) for the detection of the slightest enlargement of the bore or any permanent set, Mr. Whitworth properly considering that the first sign of the yielding of the metal, marks the commencement of the destruction of the gun; and these delicate testings enable the immediate determination of the maximum charge to which the gun could be exposed without injury. The measurements showed a set of $\frac{1}{2000}$th of an inch at the extreme rear-end of the chamber; of $\frac{1}{7000}$th at the front of the chamber, and thence to the muzzle there was absolutely no difference after the firing. This exceedingly minute difference may be readily accounted for by the wear, or by the compression of the mass of metal; and there really was in fact no actual distension of the bore. The projectiles are of hexagon shape and spiral to follow the rifling of the gun, having a windage over the major axis of 0·065 inch, and over the minor axis of 0·070 inch.

Those provided for this experiment were:—1. Common shells with parallel rears, weight 290½lbs. empty; bursting charge, 18lbs.; length, 31·6 inches; diameter, major axis, 8·96 inches; minor axis, 8·18 inches. 2. Common shells with taper rears, 285lbs. empty; same length and diameter, and bursting charge. All were filled with sand to 310 lbs. weight in the practise. 3. Hollow shot with taper rear 249 lbs.;

24·7 inches long; diameters, 8·96 and 8·18 inches. The cartridges were made on a peculiar plan, devised by Mr. Whitworth, so that the powder might be ignited well towards the front. Through the centre was passed a thin copper tube, perforated with numerous holes, over half its length. Into this, at one end, is inserted a small funnel-shaped primer cartridge, containing 120 grains of powder, the object of which is to ignite the charge of the gun rapidly, and to begin to move the projectile before the great explosion takes place. Disc papier-mâché wads, 18ozs. in weight, fitting the bore, were used. The practice with the gun could only be made at extreme low tide, on account of the great length of the range. The experiments carried out were of a two-fold character; firstly, to ascertain the suitable charge for the gun; secondly, the difference of range between shells of 310lbs. weight with parallel *versus* taper ends, and hollow shot of 250 lbs. having taper ends; and thirdly, the difference of effect between Mr. Whitworth's tubular cartridges and solid cartridges ignited at the centre of their length. In the following tables of practise, only the rounds giving maximum ranges are entered:—

Projectile.	Weight.	Cartridge Charge.	Elevation of gun.	Flight. Seconds.	Range. Yards.	Deflection. Yards.
Common Shell, Parallel Rear...	310 lbs.	tubular 45 lbs.	... 10°	13·6	4756	36 right.
"	310 lbs.	tubular 50 lbs.	... 10°	13·7	4905	35·4 right.
"	310 lbs.	tubular 55 lbs.	... 10°	14·3	5089	26·4 right.
Common Shell, Taper rear ...	310 lbs.	tubular 55 lbs.	... 10°	13·7	4910	14·0 right.

Of a further trial which was made on the 23rd November: first, to ascertain the difference in range between hollow shot of 250lbs., and common shells of 310lbs. weight, with parallel rears, and Mr. Whitworth's tubular cartridges for gun charges.

Series.	Projectile.	Flight.	Charge and Cartridge.	Elevation.	Range.	Yards in Deflection.	
		Seconds.		Degrees.	Yards.	Right.	Left.
1 ..	Shell, 310 lbs. ..	13·5 ..	50 lbs. tubular ..	10 ..	4,868 ..	—	1·0
2 ..	Shot, 250 lbs.	14·2	50 lbs. tubular ..	10 ..	5,169 ..	7·0	—
3 ..	Shell, 310 lbs. ..	12·1 ..	50 lbs. solid	.. 10 ..	4,021 ..	6·2	—
4 ..	Shot, 250 lbs.	not observed.	50 lbs. tubular ..	33	above 10,300 ..	not taken.	

Further practise, namely three rounds, was made on the following day, at the same high angle of elevation, to attain which, the wood-platform, on which the gun was mounted, was tilted up in front to the required height, and the gun-carriage strapped on by stout breeching-ropes. The following are the details of these extraordinary rounds:—

Round.	Projectile.	Flight.	Charge and Cartridge.	Elevation in Degrees.	Range in Yds.	Deflection in Yds.
5 ..	Hollow Shot, 250 lbs. ..	Not Seen ..	50 lbs. tubular ..	33° ..	11·213 ..	400 about
6 ..	Common Shell, 310 lbs. ..	..	50 lbs. tubular ..	33° ..	11·075 ..	500
7 ..	Common Shell, 310 lbs. ..	..	50 lbs. tubular ..	33°·5 ..	11·127 ..	385

The high elevation of the platform in this temporary manner necessitated, of course, the laying of the gun by the same method as is practised for mortars, actual sighting not being possible.

One instance of a very heavy gun having been fired in actual warfare at such a high elevation, is on record in the "Professional Papers of the Corps of Engineers," No. 14, 1868, in the article "On Siege Artillery in the campaigns against Richmond, with notes on the 15-inch gun," by Brigadier-General Abbot, U. S. Army.

Further trials of the Whitworth gun were made on the 11th December. With 40lb. gun charges, the shells made from 4,602 to 4,650 yards, the shot 4,547 to 4,978 yards; with 50lb. charges the shells made 5,066 to 5,131 yards, the shot 5,426 to 5,480 yards, with tubular cartridges. With 50lb. charges, solid cartridges, the shells made from 4,206 to 4,438 yards. All the rounds were at 10 degrees elevation; and the projectiles had parallel rears.

Next follows a gun from which much was hoped for, and may even yet be realized. The 10 inch m. l. r. gun, on Mr. Charles Lancaster's semi-oval-bore system, which had its first final trial on the 26th October. Its details are:—weight 18 tons 1 cwt. 1 qr. 20 lbs.; breech preponderance 7 cwt. 2 qrs. 16 lbs.; bore, semi-oval, the lower part at muzzle circular; calibre major axis 9·85 inches, minor axis 9·75 inches, spiral uniform one turn in 255 inches; length of rifling 127·5 inches, or half a turn actual in the twist of the gun. The projectiles were perfectly cylindrical, with ogival heads of 1·5 diameter, and with rear-ends of the body tapered off for about an inch. On the base were raised flat star-like rays for the bite of the wad or sabot from which the rotation of the shot is expected to be obtained; length of shot 26·85 inches, weight 400 lbs. The wads were of papier-mâché, in weight 7½ lbs. Ten rounds were fired, but all the shot wobbled from want of spin. It is but fair to the inventor, however, to state that his intention was to have had greater twist in the rifling of the gun, but the first cut having been made before he was aware of it at this very slow pitch, he allowed it to go on for trial. There is enough metal to spare to re-rifle it upon this system, taking the present major diameter for the future minor diameter, and after that the gun could still be rifled out a third time upon the Woolwich service pattern. It seems to me that the twist of the rifling should be very quick in so near an approach to a smooth-bore, to cover the probable amount of slip in the wad over the surface of the bore whilst overcoming the inertia of so heavy a mass as a 400-pounder projectile.

§ 2. *Appliances.*

The working and training of very heavy guns, a matter of the highest importance, has made considerable advance during the past year.

A very interesting part of the experimental trial of the 12-ton gun on the 15th February, was the application of Colonel Inglis's turntable, and of Mr. Cunningham's gearing. The turntable was intended to traverse a gun from one to the other of two contiguous embrasures, and, in addition to its rotary horizontal motion around its own centre, there were laid down upon its floor, arc-racers for the moving over of the carriage.

Mr. Cunningham's gear is an iron chain fastened at opposite sides on the platform, and passing over a pulley-wheel indented with sockets for the chain-links, the chain being held tightly down by rollers on each side, at a lower level than the summit of the pulley wheel, and being kept in its course by guides. This was its first practical application.

The gun was served by a detachment of one officer, one sergeant, one corporal, and eighteen gunners, many of whom were untrained men. It was variously shifted and fired through one or other of the two ports of a wooden model-casemate, the extreme traverse of the gun by the turntable through 120° of range, being accomplished in 1 minute 15 seconds, and the transfer of the line of the gun from one port to the other, in 25 seconds.

Mr. Cunningham's most convenient gripping-barrow for running heavy projectiles up to the gun, and his over-head railway for raising heavy shot and shell conveniently up to the muzzle for loading, were also used with highly satisfactory results.

This 600-pounder gun in the first instance had no other means for traversing on the table than the ordinary shod levers and tackles. The labour and loss of time in traversing by these primitive means, were very great; not less than 20 men on the tackles, and two men on the shod-levers, were required to move the gun. For training or rather laying the gun when a reciprocating movement had to be obtained, the men on the one side had to pass over as fast as possible to the other side to pull the gun round the contrary way in which they had been already pulling. As an equal number of men were required on both sides, it was not only the number of gunners employed merely for training, that constituted the evil, but the great exposure also to which these men were subjected from shot entering the embrasures or ports. Another serious embarrassment was felt in the confined space within which the men worked, especially when the gun was trained extreme, it being then almost impossible to work at all. It must also be borne in mind that when great manual power is applied by crude mechanical means, there is a want of that nicety in the application of it so necessary for laying an arm of precision, and the largest of our guns may properly so be viewed. There is a spasmodic kind of action in the effort of men which it is well known on the old system of training results in the gun being probably pulled too much on one side and beyond the object, when power has to be applied on the other side to bring the gun back again. These considerations, of course, do not refer to guns mounted on revolving platforms solely, but to guns in any position, and as regards want of space, especially to guns in casemates. This is a very serious matter when it is required to follow fast steamers. Soon after the gun was mounted on Colonel Inglis's iron table, Mr. Cunningham was requested by the War Department to apply his training gear to it; this was done in a very short time, the striking advantage in the Cunningham system being that it can be applied to guns in position without the necessity for removing the platforms to a factory to be fitted, so in this case the Cunningham gear was sent down and the ordinary artificers in the establishment at Shoeburyness had no difficulty in applying it to the platform. The result was very good. It was found that two men could traverse the gun with great precision, and could move it round from the extremes of training in 90 seconds, the distance traversed by the rear of the platform being 28 feet. This result was obtained with a crank handle. Mr. Cunningham at first turned by a hand-wheel, but the motion was slow, and he abandoned it for the common winch. It may be probably as well to note, that as by the action of the pinion and power-wheels, the chain is drawn in on one side and passed out on the other, it forms as it were a flexible-cogged-rail, and thus in whatever direction the winch is turned, the gun is drawn, and a reversion of the winch-handle, produces a reciprocating movement in the gun. Practically it was found necessary to take up the slack of the chain when the gun was trained extreme, as it will be observed that the chain in this position represents in measure-value only the chord of the circle described by the rear of the platform, the difference, therefore, between the measure of the chord and that of the circle, represents the amount of slack chain. To rectify this Mr. Cunningham at first applied a block and tackle with a snatch-hook, but he found that by merely placing stop-bolts, or snatch-bolts, as they are technically called, a little within the arc of the circle described by the rear of the platform, the chain laid itself over these bolts on one side as the platform revolved and took itself off on the other. An important practical point was thus obtained, as by an adjustment of the number of these snatch-bolts, any amount of tension of the chain can be got, and any amount of revolving distance obtained, short only by a few degrees of the actual circle.

A 25-ton gun, mounted on a fixed platform, furnished with a central pivot, has lately been fitted by Mr. Cunningham at Shoeburyness. The snatch-bolts in this case are so arranged that the gun can be trained upwards of 350°. It may be interesting in this place to notice another form in which this system has been applied, that of a 23-ton gun mounted at the new battery at Southsea Castle, fitted to traverse 90°, which gives it a complete command of the Channel going into Portsmouth Harbour. This gun was fitted by Mr. Cunningham about three years ago, and although all that time exposed to the weather and frequently to the wash of the sea-water, it is in perfect working order. In December last, on the occasion of the visit of the Defence Committee, a fast steam pinnace was caused to pass backwards and forwards in the Channel to test the training powers of the gear. When going down with the tide at a rate of say nine knots, and at a distance within 200 yards, two men moved the gun round, keeping ahead of the pinnace with perfect ease, and with a considerable amount of speed to spare. One man also traversed the gun. The men who traversed, were completely under cover of the gun and protected from shot. No. 1 man is also so covered that practically he is protected from hostile shot. The important fact then which has been obtained in the Cunningham system is, that our largest guns can be trained by two men, and these under cover of the gun. Thus, after the weapon has been loaded, all the detachment, except No. 1 and the traversing and elevating numbers, can retire under cover, whereas before, it was in training the piece that all the detachment necessarily remained exposed to the enemy's shot. The advantages obtained by this system are, therefore, unquestionably important.

Mr. Cunningham has also had in view the importance of putting the shot into the gun with as few men as possible, so as to avoid the severe labour, as well as the exposure which men are exposed to at the port in loading. Amongst the several simple provisions for saving labour, and especially for applying strength in the more favourable manners for saving muscular strain in lifting and travelling heavy weights, points in modern gunnery practice not considered so much as they should be, is the over-head railway to which I have referred. Upon this rail the projectile is conveyed to the gun by a carriage formed to travel on the rail, the projectile having been previously lifted by pulley-power to a proper level for putting into the bore. His shot-carriage for running up shot from a magazine to the gun is also an ingenious and useful affair. The over-head rail can be of course carried to any distance, and by it projectiles can be lifted from the shell-room or shot-pile in the rear or near by, and conveyed at once to the muzzle of the gun. The manual shot-lift, or bearer, designed by Mr. Cunningham is a simple and very useful instrument. The result of Mr. Cunningham's arrangements with the 23-ton gun at Shoeburyness, was that one man lifted the 600-pounder shot on the carriage, and with the help of another man conveyed it to the shot rail. Two men hoisted it up and conveyed it along the rail to the muzzle, where it was landed on a muzzle roller-bearer, and easily shoved into the gun. By the removal of the studs from the extreme base of the projectiles this roller-bearer is not required, and the shot is put directly into the gun.

Those who have witnessed the struggles and dangerous efforts of some 30 or 40 men in loading and working these huge weapons, can well appreciate the value of the relief from the unavoidable confusion and inconvenience incidental to the action of such a crowd within a very restricted space, and can equally comprehend the superior telling effect in an actual conflict, of a few men working quietly and smoothly with well-applied mechanical contrivances. In fact, it is impossible to ignore the absolute necessity for powerful mechanical means for handling with facility such enormous weights as the ever-increasing dimensions of modern cannon are bringing upon artillerymen, for in the absence of such means, the values of long range and immensely destructive projectiles will be largely deteriorated, if not actually out-balanced, by the inert intervals between the rounds in the firing. The results of this trial completely clear all fears of difficulties in the practical use of ordnance of increased size and power, whilst the success was such as must cause an extensive introduction of mechanical means in aid of human labour in defending permanent fortifications.

I come now to the subject of muzzle-pivoting guns. There can be no two opinions as to the value of some class of muzzle-pivoting for casemate and ship's guns; for not only does the small port-hole prevent the enemy from pitting in his rifle bullets, as well as diminish to a minimum the ingress of langridge through the opening, but the small port-hole is an advantage not to be overrated in adding to the strength and resistance of the iron shield or casemate-wall defending the gun. In cupola-ships the need for muzzle-pivoting is greater even than in land defences. The necessarily slow action of training heavy guns, where the whole weight has to be bodily lifted, is, however, a serious drawback to the practical value of the muzzle-pivoting system in any guise. Three systems in this direction were tried during the past year—Colonels Clerk's, Shaw's, and Inglis's.

Colonel Clerk's supports the chase of the gun at the pivoting point on the carriage, at which point, levers on either side find a fulcrum to lift the body of the gun. The shock of the recoil is taken on the levers.

Colonel Shaw's muzzle-pivoting gun carriage has been tried on board the "Royal Albert" for the 12-ton gun, and is already described in the "Journal" of this Institution.* The rear-portion of the gun is worked, as you well know, by rack and pinion and screw-motions in connection with two pairs of arcs on the sides of the carriage, the front-pair being of proportionately smaller radius than the hind-pair. The carriage tried in October last at Shoeburyness is for a 10-inch, 18-ton, 400-pounder gun; and the high charges of 60 lbs. of powder bring enormous strains upon the various parts. In the practice made on this occasion, the detachment working the gun, consisted of one sergeant and fourteen gunners; the number of men at each winch-handle to depress the gun was three; to elevate it, one. To ascertain the time required for extreme depression and elevation, trials were made with these results:—Gun at 3 degrees; to bring it back to zero, or level, 1 minute 5 seconds; depressing from zero to 4½ degrees, 1 minute 35 seconds; total time required to depress from 3 degrees of elevation to 4½ degrees of depression, that is, through 7½ degrees, 2 minutes 40 seconds; time to elevate from 4½ degrees of depression to 3 degrees of elevation, that is, to elevate through 7½ degrees, 2 minutes 40 seconds. Several rounds with 60lbs. charges were fired from the 10-inch gun mounted on this carriage at 2,000 yards range. Every shot struck close to the target; this remarkable accuracy being due to the clamping of the gun in position, so that the angle of elevation is never disturbed by the recoil, and any number of rounds can be fired without re-adjustment of elevation.

Colonel Inglis's carriage differs materially in principle from all others that have been proposed, namely, in this respect, that the gun is not made to move for elevation and depression about a fixed point at the muzzle, but is mounted on its trunnions in the ordinary way. Only, as the port admits of but small movement of the muzzle about any one centre, the position of the trunnions has occasionally to be raised or lowered, to gain room for greater depression or elevation; so that, instead of having to deal with the whole weight of the gun for each change of elevation, as in other methods, here, within certain limits, the preponderance only has to be dealt with. When those limits have to be passed, the gun must be lifted, or lowered, bodily into another position, where, within similar limits, it will work on its trunnions, as before. By this arrangement the port can be reduced, so that for an 18-ton gun, with its sights 20 inches apart, and 22½ inches above the axis of the bore (the positions, I believe, settled upon for the sights of this gun,) an elevation of 10 degrees, a depression of 5 degrees, and a lateral training of 70 degrees can be got within a port measuring externally 2 feet 9¾ inches in height, and 2 feet 5 inches in width. If, by placing the sights of the gun on its chase, or by any other expedient, the sight-line can be brought nearer to the axis, then the dimensions of the port as to height can be still further reduced. It is calculated that four men on each handle will be able to raise the gun through a space equivalent to 1 degree of elevation in about half a minute. An indicator is fixed on the side of the carriage to denote at all times the position of the trunnions, and the corresponding degrees of elevation obtainable through the port. The carriage runs on ten rollers, the object being to facilitate the working of the gun. The slope of the platform is reduced to 3°, a steeper incline being thought objectionable with the great weight of this gun and carriage.

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* Vol. ix., page 446.

The very great and important innovation in the arrangements for checking recoil which has been introduced by Colonel Clerk, R.A., the Superintendent of the Carriage Department at the Royal Arsenal, has had during the various trials of heavy ordnance carriages, trying tests which have satisfactorily proved its value, and certainly of practical action. The principle is that of a perforated piston, working in a cylinder of water or other fluid; the gun-carriage is attached to the piston-rod, and by the action of the recoil, the piston is forced back against the water which escapes through the perforations (which in the experimental hydraulic compressors employed, were four in number) the friction and resistance absorbing the momentum of the gun, and bringing the carriage up within the variation of an inch for any number of rounds with the same charges. The length of recoil is modified by the quantity of water in the cylinder. Colonel Clerk is carrying out experiments to give the exact curves of resistances and other philosophical details; and is also applying the system to the buffers of railway engines and trains, with a view to the prevention of the serious effects of collisions.

I cannot permit myself to conclude this review of the first portion of my lecture without acknowledging the value of the system of tempering steel tubes in oil, introduced practically into the Arsenal, I believe, by Mr. Anderson; nor would I omit to make one observation on the important development of future heavy guns through the researches upon the actual condition of the expansive force of gunpowder within the chamber of the gun itself.

It would be premature to announce decided conclusions as to the relative pressures of rifle-large-grain powder *versus* pellet-powder, in the present stage of the inquiry, as the experiments by the Committee on Explosive Substances have been so far made with a 2-inch gun, and although the pressure with pellet-powder was much less in this calibre, it cannot be certainly said what it may be found to be in a 9-inch gun. But I may say that the preliminary trials have shown that the pressure given by rifle-large-grain powder is very violent, and reaches a maximum in a rifled-gun after the projectile has moved about half a calibre. With pellet-powder, on the contrary, the pressure is not nearly so great, and there does not appear to be that intense local effect which characterizes the explosion of rifle-large-grain powder. The pellet-powder-pressure is much more uniformly distributed along the bore.

II.—Ammunition.

In this group a variety of questions respecting ammunition, shells, fuzes, case-shot, rockets, are brought under experimental resolution.

The question of the suitability of some qualities of the dockyard-ballast, known familiarly as "Seely's pigs," for the manufacture of Palliser-chilled-projectiles, received elucidation by a small number of projectiles supplied by Sir W. Armstrong for the service 7-inch muzzle-loading-rifled-gun fired against a 10-inch plate by Brown, of Sheffield, at 70 yards, with 22 lbs. l. g. r. p. charges. The results indicated a percentage in favour of the superior qualities of the service chilled-shot.

Questions having been raised as to the accuracy of flight of the Palliser-projectiles, a programme was arranged with a view to compare them with ordinary rifle shot and shells, and with round shot, and, by firing at a target of considerable size, to ascertain whether any difference did exist of a character to qualify their employment against vessels-of-war at moderate distances. The guns in position for this purpose were:—one 9-inch 12-ton muzzle-loading Woolwich rifled gun, one 7-inch 7-ton similar gun, one 40-pounder 35-cwt. breech-loader rifled Armstrong pattern gun, and one 68-pounder 95-cwt. smooth-bore cast-iron gun. The target was of canvas, 40 feet square, and divided across into squares of 5 feet each, a black bull's eye, 4 feet by 2 feet 10 inches, the size of the port-hole of an iron-clad ship, being painted in the centre. The distance of target from gun 1,000 yards.

With the 9-inch m. l. rifled gun, with shells, but with reduced charges of 32 lbs. l. g. r. powder, the results obtained were extra-ordinarily excellent. Three shots passed through the bull's eye; three others all but touched its right edge; and three others were within the squares upon which the bull's eye was painted, all the nine being within the inner square of 10 feet covering the centre of the target. The tenth hit carried away one of the supporting poles, and brought down the target, the practice being thus also brought to an end.

Experiments to ascertain the cause of the premature bursting of shells, were made in February, and a continuation of these trials was carried on in March, the object being to ascertain whether the premature bursting of the shells is traceable to some action of the bursting charge, or whether it may be traceable to any action of the fuze.

The Dyer or C percussion-fuze so extensively employed in the service having been found liable to premature action, two plans were proposed for the improvement of the large quantity in store. One by Sir William Armstrong, namely, the putting a leaden-ring in the bottom of the pellet to cushion it and prevent rebound when the suspending-pins are sheared on the discharge of the gun; the defect being that the pellet frequently falls with sufficient force to rebound and strike the needle, exploding the shell at the muzzle. The other, or Mr. Pettman's plan, remedies the premature explosion of the fuzes by placing a thin leaden-cup between the pellet and the bottom of the case. The pellet falling on this cup flattens it down to a disc, and the rebound is completely prevented. The great advantage of the Pettman plan is, that the alteration can be made at any station, by simply opening the fuze case and dropping in the leaden-cup; there is no need to send the fuzes to the factory for operation, as would be the case with the Armstrong method. Mr. Pettman's system was tested with 100 rounds of segment-shells, 50 from a 12-pounder, and 50 from a 9-pounder breech-loading-field-gun, with most satisfactory results. The plan has been officially adopted. The carrying out of this order has, however, been suspended.

In consequence of a recent order that all common shells should be carried loaded in the ammunition boxes of field brigades of artillery, it became necessary to devise some plan to prevent the powder in the shells from working up into the metal-socket or receptacle in which the C percussion-fuze is placed, and the plan proposed was, to close the hole in the socket by a papier-mâché wad. Then arose the question as to whether the explosion of E time or C percussion-fuzes was sufficient to blow into the shell the papier-mâché wad, and thereby ignite the bursting charge. Experiments in connection with this subject had been previously made, but in consequence of two shells not having exploded during those trials, it was considered advisable to repeat the tests.

The practice clearly showed that the fire of the fuze was sufficient to blow in the wad closing the shell-hole, and that the failures were due to the fuzes, which were not satisfactory; 32 per cent. of the time, and 8 per cent. of the percussion-fuzes, not having acted.

A third series of experiments in connection with the subject of the non-ignition of fuzes was made in continuation of the practice on the 19th of August and 17th April, to ascertain whether Colonel Boxer's 9 seconds wooden-time-fuzes for rifled guns would light in common shells specially lead-coated, as prepared to be fired with 9 lb. charges from a 64-pounder Armstrong wedge-breech-loading gun.

The practice with Colonel Inglis's gun-carriage on the 28th November was utilized in trying the 10-inch Boxer-Shrapnel shells, with a view to ascertain if these missiles were strong enough to stand the charges used, and at the same time to test the times of burning of the 9 seconds-wooden-fuzes. These shells are 32·2 inches long; and contain

450, 4-ounce iron shot, cast in sand, and a bursting charge of 16 ounces of fine grained powder; weight loaded, 388 lbs. They differ from those in previous experiments in having the communicating-tube made smooth and lacquered to prevent premature explosion. Ten rounds were fired, at from 3° 33′ to 4° 0′ elevation; nine with 40 lb. gun-charges, and one with 60 lbs. All the shells but one, burst properly, after from 4·3 to 5·8 seconds' flight, with fuzes bored at $\frac{9}{10}$ inch and 1 inch.

In December, trial was made of double common shells for 7-pounder rifled muzzle-loading guns for mountain service. The shells provided were shorter than those provisionally adopted and used by the batteries in the late campaign in Abyssinia; length, 11·3 inches, windage, 0·06 inch, mean weight, empty, 11 lbs.; bursting charge, 1 lb., total weight loaded, 12 lbs.

Thirty rounds were provided; 15 shells of the ordinary character, and 15 others having three equal and equi-distant grooves along the sides between the studs, each groove 1 inch wide and $\frac{1}{10}$ inch deep, these groves being designed for the purpose of ascertaining whether the escape of fire through them would facilitate the lighting of the fuzes, some difficulty having been experienced with the longer shells now in the service. The gun used in the trial was a 3-inch-bore bronze-gun, of 1 cwt. 3 qrs. 6 lbs.; length, 2 feet 8 inches; and rifled with three grooves.

The first practice was with the grooved shells, to ascertain the loss of range by the escape of gas.

The second series was with live shells to determine the degree of certainty of ignition of the fuzes. In these shorter shells, the fuzes ignited satisfactorily, and therefore the shortening of the length of the shells will be sufficient to remedy the defect felt in the present service double-mountain-shells without its being required to incur the loss of propelling-power by grooving the projectiles.

Experiments were made upon the liability of fragments of the shell to be blown back into the battery, when there was a superiority of powder in the bursting charge over the charge in the gun; the ultimate conclusion being that in no case would this happen, even when the gun-charge was only 3 ounces of powder, as against 16 ounces in the shell, and the missile was exploded at the mouth of the gun. The elevations given to the gun in these experiments were from 1° to 20°.

Trials with copper-studded projectiles were made on the 5th and 14th of December, the object being to test the range and accuracy of shells respectively studded 3-inches from centre to centre, and 5½ inches apart, fired with gun-charges of fine-grain powder, against common large-grain powder. Further practice was subsequently made to corroborate a previous experiment with common shells, having the rear-ring of studs removed.

The shooting appears to be good in all cases, as long as the studs are placed equi-distantly from the centre of gravity of the projectile. With the rear-ring of studs removed, the shooting is improved in sand-loaded shells by the nice balance made by the driving up of the loading material towards the rear-end of the projectile by the explosion impact; but empty shells so treated, travel irregularly.

Experiments were made in October, by Mr. Abel, the chemist of the Royal Arsenal at Woolwich, in respect to shells loaded with gun-cotton bursting charges, and with a very powerful new compound, glyoxiline; the object being to discover if it were practicable to use these sensitive substances without risk of the shells exploding in the gun. The trials were made with a 12-pounder bronze smooth-bore gun, and common spherical shells, simply plugged. Some shells (1) were loaded with 2¼ ounces of gun-cotton pellets, the interstices being filled with saw-dust; others (2) were loaded with 2¼ ounces of gun-cotton pellets, the interstices filled with half an ounce of granulated gun-cotton; and some (3) were loaded with 3 ounces of glyoxiline, the charge being fixed rigidly in the shell to prevent explosion by impact on the discharge of the gun. The practice was made with charges varying from 1 lb. to 4 lbs., the full service charge of the gun, and over water to show the effects and grazes. Of the first series, one shell burst in the gun with the 4 lbs. charge; of the second series, one also burst in the gun with the 4 lbs. charge. All the others grazed many times on the water without bursting. Of the third series, five rounds were fired with respectively 1 lb., 1½ lbs., 2½ lbs., 3½ lbs., and 4 lbs. gun-charges, but none burst, although this material, prepared by Mr. Abel, for its violent powers, is very sensitive. All these shells also made many grazes on the water without exploding. Other experiments were incidentally made on this occasion to show the value of exploding gun-cotton by fulminate-fuzes.

Case-shot has also come in for its share in the progress of war materials.

In respect to the defence of flanks and caponnieres, a trial was made (15th January) of a 32-pounder 46 cwt. smooth-bore cast-iron gun, converted to a breech-loader, upon Krupp's plan, and mounted upon a non-recoil carriage and iron platform having 15 degrees of slope. The case-shot provided were of 48 lbs. weight, containing 85, 8-ounce balls. At the first trial, the sheet-tinned iron-cases were too strong to break up with the small charges (3 lbs.) used; and it seemed desirable to resort to the old plan of sewing up the bullets in canvas bags. A further trial was, however, subsequently made (26th March) with a modified sheet-iron case, when all broke up, some near and some 50 yards from the muzzle, the charge used for the gun being throughout the ten rounds fired, 3 lbs. of l. g. r. powder.

An important point having been officially raised as to the probable existence of a hiatus between the limit of destructive effect of case-shot, and the commencement of the effective range of shells fired with time-fuzes, the question was brought to an issue by firing Boxer 8-inch shells, and 32-pounder spherical diaphragm-shells with 1-inch wooden-time-fuzes. Case-shot being considered effective up to 350 yards, the range from 300 yards to 500 yards was marked out into periods of 25 yards by screens from 6 feet by 5 feet up to 9 feet square, increasing in dimensions the farther from the gun, in order to meet the cone of dispersion of the projectiles from the burst.

The result showed that the 32-pounder shells did real execution at 375 yards, and that the 8-inch shells often began to take effect at 250 yards; the fuzes being all bored alike to two-tenths of an inch, the variations in the times of explosion being seemingly due to the degree of completeness or incompleteness of the ignition of the fuzes by the overlap of the flame of the gun at the moment of discharge, and not to any marked differences in the duration of the burnings of the composition of the fuze. The general results of the practice indicated the desirability of having the fuzes graduated to half-tenths.

In December, trials were made to test case-shot for the 12-inch 600-pounder m. l. rifled gun. The mean weight of the iron case, 90 lbs.; of the 255, 8-ounce iron sand-cast balls, 127 lbs. 8 ozs.; coal-dust packing, 12 lbs. 8 ozs, total, 230 lbs; Mean length, 11·35 inches. These case-shots were fired with gun-charges of 50 lbs. r. l. g. powder at rows of targets 63 feet wide and 9 feet high, representing a column of infantry; the first row being placed at 500 yards from the gun; the second row covering the first at 550 yards.

Four rounds at 30′ and two at 1° elevation of single case-shot were first fired, each one breaking up well, and some of the balls grazing at about 150 yards from the muzzle, the stream of bullets passing on with fearful violence, and cutting up the targets very much.

The extreme range of the cone of dispersion must have been nearly a mile; the lateral spread of the balls also considerably overlapped the targets.

Two other rounds were fired double-shotted; in both, the double-case broke up well, the balls first grazing at about 150 yards; the longitudinal range and lateral spread being as before.

None but those who have seen it, can realize the terrific hail-storm of metal from case-shot from 12-inch guns and 50 lbs. charges.

III. FIELD-ARTILLERY.

The trials of field-guns have been mainly with respect to a subject of the highest interest—the Indian equipment.

This Indian question may be thus briefly put. For years, the Indian Government and Officers of Artillery in that great dependency have opposed the introduction of breech-loading guns, partly on account of the expense which the change from smooth-bores would entail, and partly from the difficulty experienced, with the few Armstrongs sent out, in keeping them in order. For the first seven years of their employment, even at home, the breech-screws and breech-pieces were, as is well known, constantly going wrong, patterns of the latter being changed half a dozen times in as many years; whilst the fuzes and ammunition have given trouble from the first, and are now in a worse state than ever. As India, however, could no longer with safety continue dependent on a smooth-bore system, the introduction of rifled-field-artillery was prominently brought forward about two years ago, and about the same time Colonel Maxwell, the Superintendent of the Royal Gun-Factory at Cossipoor, submitted to the government in India a proposal to re-cast the existing bronze-guns into rifled muzzle-loaders, and he accordingly obtained leave to come home to carry out his plans. In the meantime, the general question of muzzle-loaders *versus* breech-loaders had been fiercely discussed in this country. A Committee of thirteen General Officers sat and unanimously recommended muzzle-loading field-guns for future manufacture. The Navy too positively objected to having any other than muzzle-loaders for ships and boats, and sixty-three 12-pounder and 9-pounder muzzle-loaders were actually made in the Royal Gun Factories for the Imperial service. Nevertheless, nothing was ostensibly decided, whilst great pressure was put upon the India-Office by the War-Office and Horse Guards to get the acceptance of breech-loading guns. Indeed, it had almost been decided upon yielding, when Lord Mayo stepped in, and it was reluctantly conceded that India should have muzzle-loading guns. A Committee has since been appointed to decide on the equipment, metal, and other points of detail. There is no doubt that India would benefit largely by being independent of England in the manufacture of guns, if it could be so arranged. An official board assembled a year and a half ago to inquire into the possibility of the Royal Gun-Factories supplying India with guns in time of war, and it was decided that no reliance ought to be placed on such a source. Bronze exists already in the Service in large quantities as a material, and it is one which can be produced in India itself by native workmen. Iron, especially, under those conditions of highest skill required in modern rifled-guns, would necessitate the introduction of European workmen and costly plants of machinery. Whereas, if the bronze be found, after a course of 1,500 or even 1,000 rounds, to be fit for field service, such guns will do admirably for the requirements of India, whilst the simplicity of construction and their reproduction to any extent by native artificers at a trifling cost, will compensate largely for any want of durability as compared with wrought iron and steel guns. Mr. Whitworth's system of compressing metal may probably materially add to the support of these views, by the increased durability of the bronze.

The Indian question of field-artillery is not likely to be limited to its own confines, but it is almost certain to extend its dimensions into a general imperial consideration.

The first practical trials of new field-guns took place at the begining of last year, when practice was made to test the range, accuracy, and other qualities of three new muzzle-loading rifled field-guns of 3 inches bore—a class likely to supersede the present service Armstrong breech-loaders. It is not probable, however, that so great a change will be brought about without a considerable amount of dispute between the rival parties of artillerists; but, happily, in this paper I am able to confine myself to the Indian aspect of the question, which has many incidental reasons in its favour, and a practical trial there, it must be admitted, would be beneficial, previous to any further adoption into the general service.

We must not, however, on the other hand, forget that a good breech-loading system has many advantages for European warfare not to be over-looked, nor ought we to ignore the fact that there is a higher rate of accident to the lives and limbs of artillerymen inherent in muzzle-loading, a risk that is increased in the use of rifled weapons.

We have alluded to the recommendation of the Artillery Commission, instituted by the Commander-in-Chief, in the latter part of 1866, and have to add here that the three guns now submitted have since been made at the Woolwich Gun Factories, to carry out this decision. The trial of them took place in January last year (1868). The weights were very uniform, being $8\frac{1}{4}$ cwts. each; all the bores were also of the same diameter, namely, three inches; but the riflings were different, No. 1 having three grooves and a spiral of one turn in 25 calibres; No. 2, with three grooves, and a spiral of one turn in 30 calibres; and No. 3, with but two grooves and a spiral of one turn in 25 calibres; all the grooves were rounded and of the same dimensions, 0·4-inch wide and 0.1-inch deep. The guns were laid at crosses at 500 yards' distance, the cross and the axis of the gun being at exactly the same height above the plane of the range. Elevation of guns three degrees. The shooting was divided into two series. First series with charges of $\frac{1}{7}$th the weight of the projectile. Second series with charges of $\frac{1}{8}$th or 1lb. 8 ozs. The two-grooved gun seemingly exhibited a slight superiority.

In March, a first trial was commenced to test the range and accuracy of a bronze rifled muzzle-loading field-gun, prepared in accordance with the proposal of Colonel Maxwell; the external dimensions and rifling of this gun being similar to those of the 3-inch rifled m. l. wrought-iron field guns previously referred to.

In May, practical experiments were made against field gun-carriages of steel, of iron boiler-plate, and against cast-iron and gun-metal naves, in comparison with wooden ones, for the wheels. Two steel $\frac{5}{16}$th inch-plates shaped into brackets, were fired at by a 9-pounder Horse Brigade field-gun with common shells weighted to 9lbs.; the charge used being equivalent to a range of 800 yards. In two hits, the steel brackets were put *hors de combat*, the steel being much indented and contorted, but the splinters not numerous. It is right to note that the brackets were not stiffened by angle-iron, as they would have been in a perfect carriage.

The like practice was continued against the wrought-iron carriage, edged up with angle-iron in the usual manner. The brackets were pierced and severely wrenched by four shots, the last breaking the left bracket in two, and the first having cut the wheel and knocked out four spokes, nevertheless the carriage still remained in a state possible to be used.

The practice against the naves showed the advantages in favour of gun-metal. The wooden nave was utterly smashed, eight of the spokes knocked out, and the rim and tyre of the wheel broken. The gun-metal nave was indented by the blow, but was forced round manually, and by taking off the washer, it turned freely over the axle-pin. One round against each nave was the test.

On the 26th October, trials of the range and accuracy of a 3-inch muzzle-loading field-gun, which had been re-rifled, were made. The shells used in the practice were weighted up to 12lbs. After thi rounds, the practice was stopped, on account of its not coming up to the standard expected.

IV. Iron and other Defences.

The year 1868 will be memorable in the annals of Shoeburyness, as well as in the military history of the country, for the battles of the iron defences; and although at a heavy expenditure, the practical value of the various principles involved in the discussion has been assessed, that expenditure will have been indeed well made, if the results elicited are properly accepted and carefully acted upon. In view of the strong iron-forts which Russia is procuring at all costs; the fine guns making in Prussia by Krupp; the very decided power of American ordnance, too arrogantly underrated, although not equal to our rifled weapons; and the certainty that all first-rate empires will greatly increase in the course of a period of years in the natural progress of development of military and naval manufacturing science and skill, their warlike means of offensive attack, it is clear that England must not permit the execution of inferior defences at vital points. The perfect protection of our dockyards and arsenals is of too extreme moment to this commercial country to be left unassured, and assured that perfect security only can be, by the best and most practical execution of the best and most practical principles.

Briefly, the views I personally hold are these, that iron must be employed for the most important positions such as are constantly open to close-attack in time of war, and the guns of which must be able to continue to fire without cessation, even when actually under hostile bombardment. Iron forts, shields, or turrets, therefore, employed in coast-defences must be absolutely invulnerable to the enemy's guns. Regarding the progress of improvement in the future, first-class iron defences now erecting should be capable of resisting 1,000-pounder guns, with 200 lb. charges of powder, at sufficiently close ranges, such as depth of water would allow of ships approaching within. Next I hold that it is quite sufficient to require any structure to bring up the shot, whatever its size, within the penetration of its whole length; that to bring it up more suddenly, overstrains the structure, and tends to its rapid disintegration and destruction. Thirdly, I hold that the defence is not a good and sufficient defence, if it does not keep the hostile shot from piercing, straining, or otherwise damaging the inner skin of the iron front. Lastly, I hold that the full power of resistance to the enemy's projectiles should be got out of the materials employed by the best mechanical construction and workmanship. I need not say that I do not propose invulnerable forts for every position, but only for those, the loss of which, would be national calamities. Having said so much in reference to my own views, it will be seen beforehand that I am more disposed to expect *absolute* security in iron defences, rather than comparative security.

The "Gibraltar" shield was to have had an attack made upon it on the 17th January of last year, but the 10-inch gun on its trial against a wooden screen, for ascertaining the true elevation required for precision with a 54 lb. charge and a 400-pounder-Palliser-missile, having in its recoil shifted the slide, operations with that weapon were deferred. Two rounds from the 9-inch Woolwich rifled-gun were, however, fired against it at 70 yards, doing considerable damage.

The iron structures shot at during the memorable week which commenced on the 17th June were:—

1st. A casemate, commonly spoken of as the "Plymouth Breakwater Fort;" but in reality only a very small portion of this target actually represented the actual structure of the works now in course of manufacture: a large part of the remainder was covered with an extra 5-inch plate, and the greatest proportion of the firing took place against 20 inches of iron, the thickness of the Breakwater Fort itself being but 15 inches, and its structure a face-plate of 5 inches, backed by two rows, one horizontal, one vertical, of iron planks, 16½ inches wide and 5 inches thick.

2nd. The "War Office Casemate," a purely experimental structure with face-plates of 8, 4½, 6, and 4 inches in thickness, and intended chiefly to test backings of various forms of iron-stringers, combined with different infilling materials.

3rd. Fifteen-inch-thick solid plates, one rolled by Brown of Sheffield, one hammered by the Thames Iron Works.

Another structure, the "Millwall Shield," was inserted in the programme, but was not shot at until some weeks later; and two other structures were also down, but had no trial during the past year.

The Plymouth-target was pierced by the 600-pounder gun on its 15-inch portion; and its projectiles broke out to the rear both rows of iron planks in the 20-inch portion. Of the many rounds fired against it, two 600-pounder shot struck on the 20 inch part, one terribly cracking the face-plate, and doing considerable damage at the rear, a piece of horizontal iron bar, 14 inches by 16½ inches, equal to 2 cwt., being broken out and hurled thirty yards away; also a piece of the vertical iron-plating, 4½ by 5½ inches, was broken away, and the remaining portions of the bar fractured by more than six cracks from 6 to 12 inches long.

Two Palliser-shells used against the 15-inch part went clean through, the first piercing the target between the vertical support the perforation in the face-plate was perfectly round, but both th middle and rear iron-planks were broken, and turned outwards, to th distance of 2 or 3 feet. A large piece of one of the iron-planks wa completely broken away. The head of the shell struck against the pi behind the target.

This round is the only one that hit upon a 15-inch portion properl representing the Plymouth structure; in all the others, the 15-in target structure was modified, and very considerably strengthened, b the use of plates instead of planks of iron.

Another Palliser-shell struck the target under the port-hole, wh r are three 5-inch plates, this being the strongest portion of the 15-in ch structure. Nevertheless, a piece of the rear plate, 5 feet long by about 18 inches wide, was broken out and hurled with immense fo ce against the thick rope mantlet placed behind the target to catch be splinters. We see here then, as distinctly as on the "Gibraltar shield," that the vibration under the heavy blows of artillery missiles, of thick iron plates against each other, is highly inimical to the endurance of the defensive structure; and that just as upon a railway, a rigid road is soon deteriorated by the blows of the engine, so in military defences, the iron plates require a suitable, slightly yielding, backing of a material different from metal, and yet sufficiently firm and so mechanically constructed as to support the plates, and take up, by the proper bearing of its different parts, the residual energy of the blow, and to distribute over as large an area as possible, the strain so suddenly brought upon a very limited area.

For this latter reason, I do not think that any practical conclusion should be drawn from the two trials made during this memorable week upon the two 15-inch plates, because they were neither of them backed in any way, and because they were set against the edges of two narrow bars, one at, or rather near, each end, a condition of affairs likely in the highest degree to facilitate their fracture. Both were broken.

Vertical fire was kept up for some days against the Plymouth target with 13-inch mortars, throwing 207 lb. shells, aimed by vertical fire against the roof, but after 200 rounds the practice was discontinued, the surface of the roof, 22 feet by 21¼ feet in superficial area, not having been struck. The range was 900 yards.

But the great feature of these experiments was the salvo fired against the Plymouth target, and aimed upon the actual 15-inch portion. The guns laid were the 12-inch, 10-inch, and 9-inch Woolwich rifled-guns, and the American 450 pounder smooth-bore. The guns were discharged by electricity, but the 10-inch rifled gun did not go off. The weight of the salvo, therefore, was 600, 400, 250—total, 1,250 lbs.—at 200 yards range. The shots took effect between the first and second vertical struts, and a large hole, big enough for a man to walk through, was cut away, giving an entrance into the casemate.

The "War Office casemate," I pass with a very summary notice, not because it does not deserve fuller consideration, but mainly because the two chief qualities it exhibited, were shown in prominence in the "Millwall shield;" those peculiarities were the soft, squashable nature of the iron used in the plates, and the hollow stringer backing.

The "Millwall shield" was designed to give several experiments, and is, therefore, neither homogeneous in structure, nor properly sightly in appearance; the main object was, however, to test a particular kind of backing patented by Mr. John Hughes, of the Millwall Iron Works. This backing consists of hollow stringers 7 inches deep, infilled with wood, and riveted up to two ¾ inch-skin plates. At the back of these is another layer of similar stringers, at greater intervals apart, the whole being supported by struts of the usual kind. In addition to this, it was strengthened by girders 12 inches deep, running horizontally, three above and three below the port-hole, and two similar girders on each side vertically, all the flanges of these girders being connected together by 1¾ inch plates. The spaces between the stringers and girders were infilled with teak, the advantage being a semi-elastic backing, highly capable of properly supporting the armour, and distributing over the whole structure, the residual force of the impact of the shot. Another advantage of this class of construction is, that it allows the use of a much cheaper form of iron, namely, a species of rails, producible for about £18 per ton, and which, when riveted up against the skin of the shield in the form of box-girders, is a most effective disposition of the material, being weight for weight as strong, or stronger, than the material in a solid form.

I am very well aware that stress has been laid upon the interference of deep structures with small ports; but I do not see serious practical difficulties on this score.

The determination of the practical defensive value of a defensive structure is by actual artillery fire, and this the "Millwall shield" has endured to the ultimate, without giving in. After receiving shot for shot in position for position with the Gibraltar shield, it has since had several more shot-holes added to its wounds from the heaviest guns. It still remains a protection for gun and men. The details of the attacks upon it are well worth noting. The first ten of the following fifteen rounds are comparable with the attack upon the Gibraltar shield, namely: four 250-pounder Palliser shot with reduced gun-charge of 37 lbs. to equal 400 yards range; one Rodman 450-pounder shot, with 50 lbs. gun-charge; two Palliser 250-pounder shell, with 43 lbs. gun-charge; two Palliser shell, with 37 lbs. gun-charge; one 10-inch 400-pounder Palliser shell, with 54 lbs. gun-charge. After these, the "Millwall shield" was attacked with three 460-pounder shells of the same nature, with 60 lbs. gun-charge; and one Rodman 450-pounder shot with 83½ lbs. gun-charge, in all cases l. g. r. powder. Subsequently four other rounds were fired against it, the last shot, a 600-pounder, hitting it fair on the 9-inch part, and knocking the whole structure bodily back a distance of 6 feet, in spite of the strong fastenings by which it was secured in position. Its front is 12 feet broad by 8 feet high.

The invention of which I have now to speak is one calculated to produce a veritable revolution in fortifications—the Moncrief gun-carriage. One cannot well think too highly of the genius which has produced a perfectly successful means of easily raising heavy guns above the parapet for firing, and sending them back below it again into a position of safety for reloading; in fact, making the barbette system, so long the irrepressible temptation and vexation of artillerists and engineers, a realized success, instead of alternately a delusive hope and a hopeful delusion. A system of combination-fire by the guns from different batteries and pits, similar to the concentration of observations upon an approaching object for the explosion of torpedoes, is being worked out.

V. Chemical and Various.

Rockets, glyoxiline, and signal lights are all that are included in this category, and, although not strictly within the scope of a lecture on artillery practice, yet as they complete the entire series of experiments at Shoeburyness, the few sentences required for their notice will be well accorded.

Hales 9-pounder rockets, made at the arsenal, upon a modified plan, were tested in February. Formerly the cases were made of drawn-tubing, which was liable to split. The cases of those under notice were of sheet-iron, riveted and brazed, and having three corrugations to prevent the composition giving way during flight. The tracks made in firing were very creditably straight and low. A V-shaped trough was tried as well as the ordinary tube for directing the discharge, the trough presenting decided advantages, and permitting the use of the ordinary service friction-tube. The trials showed that 10 degrees of elevation are as much as are practically useful—the composition having ceased to burn just before the rocket came to earth, with the range thus obtained.

In March, some 24-pounder Hale's rockets were fired to test a trough designed at Shoeburyness. These were placed at various distances in the trough, at an elevation of 9 degrees, and some grazed at 150, others at 400 and 600 yards distance. It was ascertained that the rockets made one whole turn in 5½ feet, as shown on the trough by the gas marks from the vent.

A V-shaped rocket-trough, made at the Woolwich arsenal, was tried in May (24th), with 12-pounder and 24-pounder Hale's rockets, at 10 degrees elevation, and answered well. The trough, 5·8 inches wide, was formed of angle-iron, and supported at the rear by two short legs, and in front by a single tall rod, with an elevating scale and clamp. The weight of the apparatus was 64¾ lbs., its length 5 feet 6 inches.

Between Southend Pier and the shore, Service-signal-lights (5th March) were tried a distance of 1¼ mile, against similar signals prepared by Mr. Abel, with magnesium in the composition, the latter having a marked advantage.

I cannot conclude this lecture without duly acknowledging the permission so constantly accorded to my applications to attend these most valuable experiments, by the Secretary of State for War, and the authorities of the War Office, and through which I have been enabled so usefully to record these important results. Nor ought I to omit to testify my high appreciation of the able manner in which those experimental-trials have been conducted by the late Ordnance Select Committee and the present Director-General of Ordnance. The courteous facilities for taking accurate observations afforded me by the Commandant and Executive at Shoeburyness, have also my grateful acknowledgement.

Evening Meeting.

Monday, April 3rd, 1869.

GENERAL SIR WILLIAM J. CODRINGTON, G.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 19th April and 3rd May, 1869.

LIFE.

Croft, Richard B., Lieut. R.N. 9*l.*
George, T. Barry, Ens. 13th P.A.L.I. 9*l.*

ANNUAL.

Farrant, H. A. M., Captain 1st Devon Militia. 1*l.*
Walker, J. B., Captain R.A. 1*l.*
Ogg, G. W. S., M.D., Surgeon Madras Med. Serv. 1*l.*
Hume, Francis A., Captain R.N. 1*l.*
Coffin, Sir Isaac C., K.C.S.I. Major-Gen. H. M. Indian Army. 1*l.*

MOVEABLE STEEL MANTLET FOR THE PROTECTION OF ARTILLERY AND TROOPS.

By CHARLES B. EDDY, Esq., M.A., &c., &c.

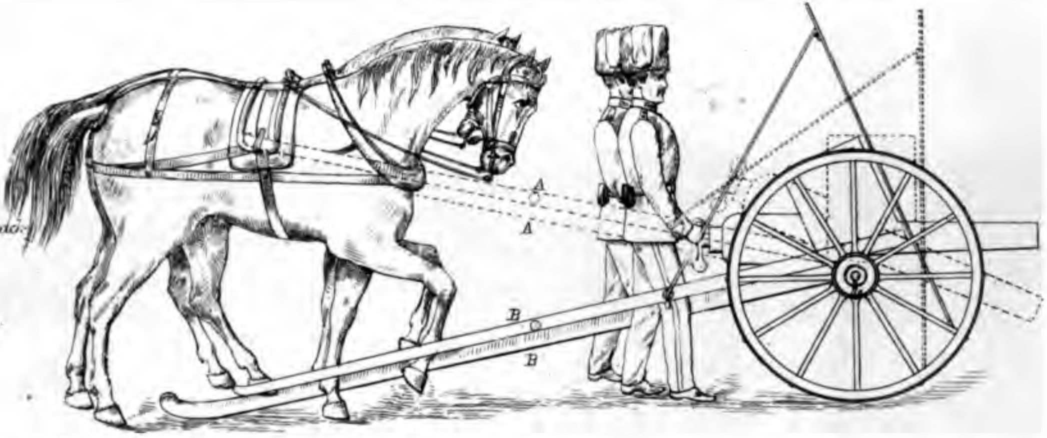
THE defence of our country, and the protection of its defenders, are matters of such general and absorbing interest, that I will offer no apology for having availed myself of the opportunity so obligingly afforded me of bringing before you an invention intended to promote these national objects. I have, in common with many others, been struck by the extraordinary superiority which has been attained for some time past, and more particularly since the introduction of arms of precision and breech-loaders, by a mere mechanical aptitude in the use of such weapons over the great soldierly qualities of boldness and strength and disciplined valour, which formerly decided the fate of empires, and for which British troops have always been distinguished. I cannot but regard with dismay the worse than uselessness of these noble endowments when merely leading to the exposure of brave men to the sweeping and desolating havoc produced by the rifle and shell-practice of modern warfare.

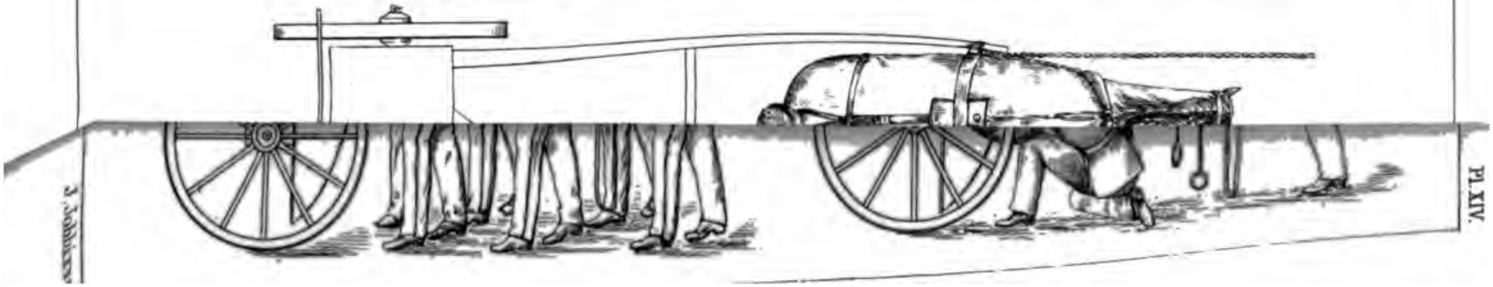
My attention to the subject has been more particularly roused of late,

Fig. 1

A.A. Trail and Shafts when approaching enemy and under fire

B.B. d° when prepared to fire





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by the deplorable and humiliating accounts which for a long period mail after mail continued to bring from New Zealand, of the discomfiture of the colonial levies by a handful of savages, occasioned solely, as I believe by the fact, that those savages, besides being skilful in the use of weapons purchased from us, habitually practice, and have become expert in methods of rapidly protecting themselves from fire; and that the British colonists did not condescend to imitate this common-sense-method of fighting, a method which they in like manner with our own troops, are apt to stigmatize as sneaking.

The disasters sustained in that colonial contest, must I think convince every one of the absolute necessity for cultivating all the methods and appliances of cover which can be made available, and indeed, it is, as I understand, a subject to which our military authorities are now paying particular attention.

The interesting work lately published by Sir F. Head, "The Royal Engineer" dwells with great emphasis on the backwardness of British troops in this respect—he says at page 352:—

"There are two facts, which I humbly submit, it is impossible for "any competent military authority to deny—

"1st. That of the armies of Europe, that of England, is at this "moment by a long interval, the most ignorant in the art of self-"defence against the desolating fire of the breech-loading rifle.

"2nd. That in its present state of wilful ignorance, it is incom-"petent to contend against any one of those highly-educated armies "above referred to, in equal numbers."

To these observations, I may add, that it is notorious, that the great contest of modern times, the American Civil War, was waged as much by the pick and mattock, as by arms. It was very soon recognized in that struggle, that some method of cover had become an essential condition of fighting; but the difficulty of inducing our troops to practise the art in time of peace, so as to acquire skill and aptitude in thus entrenching themselves, is admitted to be extreme, as witness Sir John Burgoyne's testimony.

It has been in the hope of finding a remedy for this condition of affairs, a substitute for the spade, and a method applicable alike to the defence and the attack, and also one to which men can be systematically trained, that I have devised this mantlet on wheels; the object which I aim at, being to enable our troops once more to close with their enemy, being certain that they will then vindicate their old renown, whereas, should they as now drilled, meet any of the more specially trained armies, above spoken of, one could only anticipate for them a fate similar to that of the Danes or Austrians when contending with the Prussians, or of our own Cavalry in the Balaklava charge, they would die like brave men, but they would die.

This mantlet is a moveable shield, which, with modifications for the particular purpose, may, as I think, be made available for protecting the smaller classes of field-pieces and howitzers, such as the 9-pounder breech-loader represented in Figs. 1 and 2 (Plate xiv), enabling them to advance in line with the Infantry, and with their muzzles towards the front, or for the mitrailleuse guns, such as the Gatlin, which are being adopted in some foreign services, and may probably be introduced into our own, and which also possess the great advantage of advancing, muzzle foremost.*

I propose that these field-pieces or mitrailleuse guns should ordinarily be drawn by four horses, but with double shafts for the wheelers, so constructed as to form the trail when the gun is to be fired, and of such width, as to admit of the position of the wheelers being reversed in them, as shown in Fig. 1, that when in presence of the enemy, and preparing for action, the wheelers should thus wheel the gun, and shield before them, and the leaders draw by hooks from the naves, and that when about to fire, the shafts forming the trail should be lowered, and the gun be laid by a wedge resting upon them, the horses being withdrawn to the rear. My calculation in proposing this arrangement, is that the weight of the shield being added to that of the gun, will check the force of the recoil, and obviate the necessity for great weight and solidity in the trail, which I propose to make of wood strengthened with iron.†

The mantlet may also be adapted for bringing up the ammunition, intrenching tools and stores to the front in action, and for protecting rocket-batteries. But it is also a principal part of my design that these shields shall be used for the shelter of Infantry either in approaching breaches or intrenchments, or for protecting the heads of columns formed for carrying important posts, or even for giving or receiving the attack in the open battle-field; and when drawn up, or advancing in line for this purpose, I imagine they would be useful for masking, and partially protecting the heavier field guns, whilst taking up position, and Cavalry and bodies of Infantry whilst manœvring in the rear; for an iron wall 6 feet high would not only stop many missiles, but by intercepting the view, would make it difficult for the enemy to get the proper range of objects behind it, the height of the shields being 8 or 9 inches above the line of sight, so as effectually to prevent that. On the other hand, in order to facilitate the fire of one's own troops, the shield is adapted to be readily lowered, as may be seen in the diagram, Fig. 6. The lines of trajectory shown in Fig. 4, indicate the distance to the rear, which at near ranges, is fairly protected by a shield of the height shown, a height which, if considered desirable, might be somewhat increased within reasonable limits of weight; it must, moreover, be borne in mind, that all improvements in fire-arms, aim at obtaining a lower and flatter trajectory, thus increasing the area of protection behind such an iron wall as this.

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* This engine of destruction, so formidable at near ranges, though now passing under a foreign name, was, I understand, originally invented by an English Officer, Colonel Martin, and a model of his invention has been deposited in the Museum of this Institution ever since 1861.—C. E.

† The advantage of bringing guns into action muzzle-foremost, and protected by a shield, has long been recognized. In the very earliest days of artillery, viz., in the 14th century, a plan of this kind was proposed with a mantlet, like a Venetian blind, for protection from arrows. An amusing drawing of this may be seen in the paper by Major W. H. Ross, R.A., on Field Artillery, read before this Society (see Journal, vol. xii.), but the necessity for its protection against musketry, has only risen into great importance since the vast improvements that have been made in rifle practice.—C. W.

I look on this power of protecting artillery as one of the principal uses to which such a system may be applied, for I believe it is acknowledged to be, under existing circumstances, almost, if not altogether, out of the question to bring artillery drawn by horses, within a telling distance of a line of infantry in skirmishing order, unless the nature of the ground should happen to favour its advance; and in that case the heavier pieces, *i.e.*, the guns of the horse artillery, being unconnected with the shields, could advance rapidly, just as at present, to take advantage of it.

The infantry mantlet, which I have had made and exhibit, is of ⅜ths Bessemer steel, weighing 15 lbs. per square foot; the whole plate, which is calculated to cover six men disposed as shown in the diagram, Fig. 4, weighing about 2½ cwt. The entire machine weighs about 4½ cwt.

The piece of the plate on the table has been proved, both with the Snider-rifle and Boxer-cartridge, and with the Martini-Henry rifle and cartridge with hardened 1 oz. ball, a weapon and missile which, without doubt, greatly exceeds in penetrating power any arm at present in use in any Service. You may observe that three shots have struck it almost on the same spot without any sensible effect; these were with the new cartridge and hardened bullet, and were fired by Mr. Lancaster at 30 yards. The resistance of this and the other plates on the table has been such as to make it almost appear that I have erred on the side of excessive thickness, but I have designed the shield as a protection, not only against small arms and canister, but against shrapnel and the mitraille from the Gatlin or other mitrailleuse guns, the balls from any of which I believe it will divert into a comparatively harmless direction, when lowered to such an angle as will still afford adequate protection to men crouching and firing from behind it. This is shown on diagram, Fig. 6. It is also intended to give protection against the explosive bullets, which are said to have so demoralising an influence on troops, and the effects of which are described as so horrible, that the use of them has lately been made the subject of an European Congress.

Against the impact of solid shot, grape, or vertical fire, this shield would, of course, be useless, and it must take its chance against the danger of a cannon ball's hitting it, or of a shell bursting directly overhead: but when the small distances at which grape can be employed with precision, is considered, it appears pretty certain that the guns throwing it would be silenced before they could be very dangerous to troops advancing under cover of these mantlets. There is, indeed, one small-arm-missile which would pierce this, or probably any shield that could be constructed within the necessary limits of weight, I mean Mr. Whitworth's steel-bolt, but the difficulties in the way of its adoption are such as probably will always preclude its general use. It will be observed that my shield is of twice the thickness of the steel sap roller invented by Serjeant-Major Knight. The thickness of this, viz., $\frac{3}{16}$ths of an inch, is, however, practically increased to ¼ of an inch by the angle at which it is placed. A revolving musket-proof mantlet for embrasures has been proposed by Quartermaster J. Jones, R.E., and he appears to have come to the conclusion that a plate of homogenous iron, weighing only 6lb to the foot, or ⅐th inch thick, would suffice. The thinnest plate which I should think safe without a backing, would weigh 10lbs. per foot, or be ¼ inch thick. The round plate on the table, however, of ⅛th inch homogeneous iron, weighing 8lbs. to the foot, has resisted actual penetration, and perhaps this, with a thick pad behind it, might suffice, but the best thickness to adopt must be a matter for experiment: all that I am contending for, is the adoption of the principle. The success of this plate has suggested to an ingenious friend of mine the idea, that shields containing about 2½ square feet each, and weighing 20lbs., might be fitted into a strong iron frame placed on wheels, so that when independent action is required each man might advance with his separate shield, as shown in the model before you. I fear, however, that unless the frame were very strong, and therefore heavy, the first shower of shrapnel would knock it all to pieces. Should the system which I advocate be taken up, and the attention of manufacturers be directed to the production of bullet-proof steel in the same manner that it has been so successfully to shot-proof armour-plates, it is not improbable that improvements may yet be made in the combination of resisting power with lightness, and that a safe mantlet for general purposes may be constructed, involving much less weight than my present shield; meanwhile however, I do not think this involves anything prohibitive in respect to weight or unwieldiness; it is run with ease by one man on hard ground, and the six men who would be sheltered by it, can all bear a hand in wheeling it whenever the nature of the ground requires additional force. It will be observed that the side pieces can be readily detached; they are intended, whilst ordinarily increasing the area of protection, to be laid across any gap or ditch requiring to be crossed, and when detached, the machine will pass through any gap in a hedge a yard wide, or an ordinary doorway.

The weight of the whole machine, as now constructed, is rather more than double that of the hand-ambulance or "China barrow," and this is intended to be wheeled anywhere by one man; but I am inclined to think, as I have already hinted, that the result of experiments with shrapnel would be to show, that the weight might be reduced without sacrificing efficiency,* and I should be glad to submit it to any experiments; it is not, however, easy for a private person to make such experiments without the assistance of Government.

Having traversed almost all those parts of Europe over which great and decisive battles have been fought, and which, as surrounding the great capitals or commanding the principal roads of approach to them, are likely to be the chief scenes of future conflicts, I feel confident that such mantlets might be moved in line across any of them when the ground is not very heavy nor the land covered by standing crops. The great battle fields of Europe, such as those of Belgium and the Palatinate, the fields of Leipzig, Jena, Austerlitz, Dresden, Ulm, Wagram, Aspern, and the plains of France, are all an open country, without fences or ditches of any consequence; in wet weather the shields might have to keep to the roads, but I think I may claim that they could go wherever field artillery could advance, and also that if the shelter they afford should enable an attacking force to advance along the roads, they would insure its penetrating or outflanking, and so carrying any position which would be worth defending; for it may be assumed that defensive positions are, and indeed must be, chosen for the defence of roads and railway junctions, or other lines of communication, and accordingly the key of a position usually rests on a road.

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* The quarter-inch-steel-plates on the table, which have been tested both with the Snider and Martini-Henry rifle and cartridge, prove that good plates of this thickness are practically rifle-proof, and if, as I believe, these may safely be substituted for the present ones, the weight of the mantlet may be reduced by 100lbs., which would admit of one thousand rounds of ammunition being carried within the same limit of weight; each shield would then be a perfect volcano of fire.—C. E.

With reference to the adaptability of the system to the rapid movements of Armies in a campaign, it will be observed that these shields can be drawn by the men reversing their position, and this would be the easiest way on a march, and that they admit of the men's packs, great coats, arms, and ammunition being placed on them. They could also be assisted in rapid marches by horses with the lasso-equipment, with which a considerable proportion of every troop of cavalry and artillery is now provided. When it is considered that every soldier on the march must carry articles with him, the weight of which amounts to about 50 lbs., and how much more easily burthens are wheeled than carried where roads exist, I think it may probably be found in practice that, far from encumbering an Army, these machines on wheels, by relieving the men of weight, would enable them to outmarch and outflank those that have to carry their kit, that is, to do more than the present average of about ten miles a day. Supposing, however, it should be found more fatiguing for the soldiers, though working by relays, to wheel these shields laden, than to march under their kit, as now, I doubt if anything would be lost, for it is not improbable that the training requisite to enable troops to handle them freely, would prove so advantageous as to give them a clear superiority in the contest, in like manner as the laborious training which the Roman legionaries underwent to enable them to march under their ponderous arms and accoutrements, gave them an irresistible superiority when they met the foe.

The weights carried, and the marches made, by modern troops appear, indeed, contemptible, when compared with those of soldiers in the middle ages, and of the Greek hoplites and the Roman legionaries. It seems probable that the latter under the Scipios carried 60lbs. weight besides their arms and seven intrenching stakes, and their usual march was 20 miles (or double the length of a modern day's march), and we know how they vanquished their lighter armed enemies. It seems, indeed, established by the concurrent testimony of history that the lighter armed and accoutred forces have almost invariably succumbed in the shock of battle before those which have been more heavily armed, and I think the superiority on the side of the latter may fairly, and with great probability, be ascribed to the high physical development and powers of endurance engendered by their training. At all events, weight appears to tell in the conflict. Referring to the intrenching stakes carried by the Roman troops, it is known that the legions never encamped for the night without intrenching themselves. This practice ensured them a period for rest and sleep, less subject to disturbance than can be enjoyed by troops not so protected, therefore requiring a smaller proportion of the men to be on guard and picket duty. May not this, in great measure, account for their apparently greater powers of endurance? and might not similar advantages be enjoyed by a division of a modern army, furnished with the ready means of surrounding themselves with a rampart which these shields would furnish? The proportion of mantlets, which I propose to allot to each regiment, would enclose six-sevenths of an acre, and those of four regiments combined, about ten acres, or 57,000 square yards; it is evident, therefore, that with the help of these and the artillery and ambulances, rocket, and store waggons, &c., a division might readily surround itself with a formidable rampart.

As regards the number and disposition of such shields on a field of battle, I would suggest that an army adopting them might be advantageously divided into heavy and light troops; a battalion of the former, 1,000 strong, with three or four guns in line, having say 180 shields, would show a front of about 720 ft., whilst an equal number of light troops without shields would act as tirailleurs on the flanks, and form a reserve ready to strengthen the column for the final rush. If the system of mounted infantry, which was found so useful in the American contest, should be adopted into our service, I should think a couple of horses might advantageously accompany each shield, one of which could then wheel it forward when under fire, in the manner represented in Fig. 1. The shafts can easily be adapted for this.

The lines of trajectory marked in Fig. 4 show how slight the drop of the bullet is at moderate ranges, till the nearer to the shields the more complete is the protection; therefore, it may be supposed that the instinct of self-preservation would keep the reserves well up to the front, and would deter from straggling, and thus inspire that tendency to massing and mutual reliance which is said to be so valuable in infantry, and to give so decided a superiority to the troops that possess it. Should such a method, as I have here indicated, be found even moderately successful, I think there can be no doubt but that it will confer so great a superiority on the troops that adopt it, as to force its adoption on other nations as has been the case with armour-plated ships, with the Minié rifle, and with the breech-loader, but I am far from thinking that our national advantages would thereby be neutralized. I believe on the contrary that those great qualities of British troops, calm and intrepid courage, steadiness, and endurance, which have met with such enthusiatic admiration from hostile commanders like Napoleon, Marmont, Marshal Bugeaud, and Can-robert, would then once more assert their proper ascendancy. I think it will be found that the adoption of defensive armour, such as this, will by no means render these qualities obsolete or useless, but rather that by wresting from the mere marksman the advantage which he now too exclusively enjoys, and by bringing the issue of battle once more to a hand-to-hand contest, it will restore the superiority to those physical and moral endowments which constitute true manhood, and to which the superiority properly belongs. I hope it may prove so, for I hold with the Chevalier Bayard, "C'est une honte qu'un homme de cœur soit exposé à périr par une misérable frequenélle," and with the Marshal de Montluc, "Would to God, that accursed instrument (the arquebus) "had never been invented, many brave and gallant men would not "then have been killed by cowards, who would not dare to look in the "face him whom they murder with their wretched bullets." In fact, should some such means of neutralizing the murderous fusillade be adopted, I think a small, well disciplined body of strong, resolute, and steady men, such as our army is mainly composed of, would drive before it a larger number of inferior troops, though similarly protected, as certainly as the Macedonian phalanx, or the Roman legion drove before it the hosts of Asia and of Africa, as certainly as they themselves have borne down all opponents in the bayonet charge, a charge which is now regarded as a thing of the past, but which I hope may thus be restored. I believe our troops would thus recover that clear superiority over all continental forces which for centuries they have undoubtedly possessed, but of which the mechanical improvements of late years introduced into the appliances of war, have probably, in some measure, deprived them.

Armour has been introduced into the Navy, and it is now admitted to be an essential condition of naval engagements, why should it not be also admitted into the Army? Let it not be supposed that its use is any indication of cowardice; far from that, the shield is the very emblem of chivalry, it was the inseparable companion of the soldier during the most heroic periods of modern, *i.e.*, mediæval as well as of ancient history. Not only was it borne by the knights and men-at-arms in the middle ages, but the English archers—that glorious infantry, which so nobly sustained the honour and greatness of England during two centuries—fought behind a wooden pavois, or shield. One of these pavois may now be seen in the Meyrick Collection of Armour.

Armour was, in fact, from the earliest historic periods an attribute of advanced civilization and high culture, and continued in universal use until improvements in fire-arms rendered it impossible to carry anything that was proof against the force of gunpowder; and from that time, I think the only method of restoring the balance, and giving heroism once more a fair chance against mere manual dexterity, has been to place the armour on wheels, as is here attempted. The expense of these shields, if manufactured on a large scale, would not I think be more than 5*l.* each, in fact, as steel is becoming nearly as cheap as iron, and as one to every dozen men of a division would probably be an ample proportion, the expense would not be extravagant. The fact, however, of the equipment of an army for the field being thus increased, in like manner with the invention of armour-plated ships, and every other improvement in the mechanical appliances of war, tells necessarily in favour of high civilization and its concomitant, wealth, for it gives an incontestable advantage to the highly-organized, thoroughly trained, and well-equipped forces of a wealthy state over the raw levies of more populous but poorer ones, to a standing army, though but small, over levies *en masse* and the Landwehr. Moreover, this advantage cannot but be enhanced in the case of a great manufacturing and commercial nation like ourselves, pre-eminent above all other nations in the possession of iron, and in the means and facilities for working it: to make an iron rampart an indispensable adjunct of armies, is to give us at once a vast superiority.

Inventions of this kind, which increase the *impedimenta* of armies, are also obviously favourable to us in our insular position, for the embarkation and the landing of such shields involve both time and the limitation for the spots for disembarkation to localities favourable for the purpose, and thus greatly diminish the chances of a surprise, the only real danger to which England is exposed.

The CHAIRMAN: If any gentleman wishes to make any remarks upon the proposal of Mr. Eddy, we shall be very glad to hear him. It is a very ingenious suggestion, but its applicability is the question. There is one point upon which I should like to ask for information: how is this mantlet to be moved on a march; and, if you are advancing to attack, how are you to move this with the men carrying their knapsacks and rifles?

Mr. EDDY: Each of these will shelter six men, and all the six men can help to move it and follow it. The way in which they are harnessed in, is simply by a rope with a handle in it, which they can drop in a moment. They carry their rifles in one hand, and with the other pull the rope. The thing is easily run over hard ground, such as a good road, by one man, because it is so evenly balanced that there is no weight on the handles. I believe six men can run it anywhere, at all events, anywhere where field artillery can go.

The CHAIRMAN: What is the height of the wheels?

Mr. EDDY: Rather more than three feet. The weight of this plate which I have made three-eighths of an inch thick, is 4½ cwt. But I have no doubt, whatever, that I can easily reduce the weight. With plates of this thickness (pointing) it would be only 3½ cwt. And if these plates (pointing), which have been proved with the Henry-Martini rifle, were considered sufficient, they would reduce it still more. The weight of this plate is only about half.

The CHAIRMAN: Is it a steel plate?

Mr. EDDY: It is of homogeneous iron, and the whole weight of this plate is about 3 cwt.; so that for six men each man would only have to wheel half a cwt. Then, instead of carrying their knapsacks, they would, no doubt, strap their knapsacks on to the box, and the box would carry their ammunition protected by the plate in front. Each of these boxes would carry 1,200 rounds of the new arm. 1,000 rounds weigh about 100 lbs. But on the march, with the plan of mounted infantry, which is very advantageous, the best way would be to attach one horse at least, say two horses, which could wheel the shield independently of the men. This drawing (Fig. 4) shows the protection which the shield gives to six men, they are almost entirely protected, except part of the leg of one man.

Colonel GRAY, R.A.: May I ask how that light field gun (Fig. 1) is propelled? how is the draught thrown on to the weight of the gun? and how is the shaft [illegible] the horse and then to the gun?

[illegible] By a chain and a hook.

Colonel **Gray**: Do you fancy they exert the same motive power traced in that way?

Mr. **Eddy**: Certainly not; but they can be reversed on the march (Fig. 2). Four horses can be attached as at present. In action they would be under cover, attached in the same way as horses are attached to a Crosskill's reaping machine (Fig. 1). The resistance to a reaping machine going through a field is very great; but it is found that two horses put on behind can push a reaping-machine forward and cut the corn down. In the same way this shield can be pushed forward in front of the enemy. It is intended that two horses shall propel the machine when it is under fire, and then the horses are taken out to afford cover for the men (Fig. 3).

Colonel **Gray**: Can you take that gun over a hill?

Mr. **Eddy**: I do not know that I can in this way (Fig. 1). But four horses could draw it, just in the same way as they do at present on the march. It is only in the presence of the enemy that two horses, protected by the shield, would push it forward. Still, they would have the same power that horses have in pushing a reaping machine.

Colonel **Gray**: Do you think the shield adapted for field artillery? Suppose the shield were shot away, do you not think the gun would be rendered unserviceable on account of the want of a proper trail?

Mr. **Eddy**: I propose that this should be of wood, strengthened by iron. It is a long trail; therefore, the weight need not be so great.

Colonel **Gray**: You say the shield exercises a certain amount of compensating weight for lightening the trail? It appears to me that your gun would be rendered much more easily unserviceable than one of our present guns. Do you not think it would?

Mr. **Eddy**: Very likely. But then, it seems to me a great point to protect your horses under fire. At present the horses are unprotected.

Colonel **Gray**: If the shield were shot away, I should think the gun would be rendered unserviceable by one shot.

Mr. **Eddy**: A shot might pass through it, but I do not think the shield would be carried away. Of course, a gun can be easily disabled by a shot now.

Colonel **Gray**: Of course, that is the difficulty. Yours is a very good plan if you can carry it out.

Mr. **Eddy**: In all these things there must be a balance of advantages and disadvantages. There can be no advantage without some corresponding disadvantage. But I suppose it would be a great thing to bring up guns under heavy fire with protection to the horses, because within moderate ranges it is so easy to disable a gun by shooting a horse; if you can protect the horse it is a great point gained.

The **Chairman**: That is supposing your artillery fire is less effective at any distance than infantry fire. Is that the fact?

Mr. **Eddy**: I should have thought it was.

The **Chairman**: That is the question.

Colonel **Gray**: The range of the Armstrong gun is fully equal to that of any rifle that has been invented; therefore, I think you would find in an artillery engagement that your gun would be much more quickly unserviceable than the present style of gun.

The **Chairman**: The question is, why should you bring your guns under the fire of infantry if they have a superior fire?

Colonel **Gray**: It would be a mistake to bring your artillery under infantry fire. All your men and horses would be probably rendered unserviceable.

The **Chairman**: You do not propose your shield as effective against any artillery fire?

Mr. **Eddy**: No; but against shrapnel, yes.

Colonel **Gray**: I think that is its weak point, that the gun would be quickly rendered unserviceable.

Major **McGwire**: Another objection appears to me to be that if the shield were struck by a rifled shot, the splinters from it would have the same effect on the men and horses that a shrapnel would. If that shield were struck by a shot it would fly into splinters, and tney would act as a shell.

The **Chairman**: It is made of wrought iron, is it not?

Mr. **Eddy**: Yes, of wrought iron.

The **Chairman**: I do not think that wrought iron would have the same effect as cast iron.

Major **McGwire**: But if the shield were split.

Mr. **Eddy**: I have not had the opportunity of trying it with a round shot, but I fancy a round shot would go through it.

Major **McGwire**: I think you would find that it would be shot away in a very short time.

Mr. **Eddy**: This plate shows no splinters. It has been fired at with one of the new bullets, lead hardened with tin. I fancy as the shield is made of homogeneous iron, that a round shot would go through it.

Major **McGwire**: That drawing (Fig. 4) represents the shield on level ground. If the men were marching on very fair ground they would be able to see the ground that they are marching over. But over rough ground they could not possibly keep their order of march.

Mr. **Eddy**: It is only when the men want to be protected that they would not march freely. The shield is so light that one or two men can run it alone over any ordinary ground. It is only when they are in front of an enemy, and want the protection of the shield, that the men will crowd behind it. Then they would be in the order shown on that drawing.

Major **McGwire**: Another disadvantage strikes me. That seems suitable for level ground, but in attacking a height, the troops would, in nine cases out of ten, have to descend a hill into a valley before they could ascend the height upon which the enemy is posted, and they would be exposed all the time they were descending the hill and crossing the valley.

Mr. **Eddy**: Whenever they want to fire they can lower the shield in this way (Fig. 6). There is another way of protecting themselves, that is by kneeling with one knee on the frame; the other leg is protected by the wheel, and they fire over that. It forms a breastwork, only the head is exposed. But if they wanted to fire a distance of a thousand yards they would pull up the shield and fire lying on the ground.

Major **McGwire**: It is very hard in manœuvring troops to keep line or formation of any kind; even to form front from column is very difficult, because the men have to work zig-zag, they seldom come in a straight line to arrive at their point. Has the shield ever been tried under these circumstances?

Mr. **Eddy**: No, I have only just made this shield; but if the men were attached to the shield, and were protected by the shield, I should have thought that they would keep close behind it for shelter.

The **Chairman**: There is no doubt that all these are interesting subjects for discussion. Whether the inventions are practical or not, is the point that we are met here to consider, after one has had the opportunity of looking at them. The difficulty with all inventions of this kind, is their portability; how are you to get these things to the places where they are to give cover? There is no doubt that a gabion, a rifle-pit, or a steel mantlet, or anything that can give cover, is a very good thing, but how you are to get these things, invented to give protection, where they are wanted, appears to be the difficulty. There is no doubt that the discussion of these questions is exceedingly interesting in a military point of view. We are very much obliged to Mr. Eddy for bringing this plan before us, and for the trouble he has taken in giving rise to a discussion on an interesting point of military warfare.

AMMUNITION SUPPLY CAR.

By Lieut.-Colonel T. Martin, late 4th K. O. Regiment.

The supply of ammunition to meet the requirements of the present breech-loading rifle has necessarily become a matter for serious consideration: the fear that men will expend too many cartridges in action has already been expressed by high authorities, and all sorts of *dodges* are had recourse to to prevent soldiers firing too fast; for instance, shouting out the names of men to fire during independent firing, desiring men to expend only two or three rounds on any given occasion, or making men count twenty paces between each shot while firing as skirmishers halted. Hints to Commanding Officers, entreaties to Officers, cautions to Supernumeraries, and orders to men, fail to restrict the expenditure of blank ammunition on pageant field days; the only means I can recommend, for conquering the *propensity*, is to tie two rounds together, and thus compel the men to untie them before firing them off. All this firing may answer to keep public expectation up to the mark; because, on such occasions, a "bouquet" of fire becomes as essential at the conclusion of a field day, as at a gala-night at the Crystal Palace.

If field-days are for the gratification of an admiring public, and to be got up cheaply, let us by all means obstruct the soldier in his endeavour to shorten the field day by showing off his Snider; but when our field days are for instruction, the soldier should be taught the real value of his breech-loader, and to become acquainted with "his own power," and how to use it on occasion when the favourable turn of the tide of battle may depend upon his being able to fire rapidly and well.

It does not require much experience for a private soldier to learn the value of *ball* ammunition on service; he may on a field day do his best to get rid of *blank* ammunition, in hopes of shortening the drill, but, in action, the consciousness that his life may depend upon the good use he makes of his *ball ammunition*, will influence him not to waste it.

We must not now-a-days judge of the soldier-element by the antiquated standard, which counted it perfection "that soldiers should not think;" that old-fashioned brutalizing idea has been swept away, and the educated British soldier of 1868 "thinks," and feels, that he has as much right to indulge in the luxury of thought as any one; and it cannot be denied that the march of intellect in the British soldier has kept pace with the improvement in his weapons.

"Extra ammunition" is now the outcry, and many suggestions have already been made, and experiments tried, as to the number of rounds a man should carry, and how he ought to carry them, but *all* agree upon flooring knapsacks during actual service.

As the map of Germany was changed in seven days, we may modestly suppose that any other map may be altered in a fortnight. We all know that a man can be clothed and shod to meet the wear and tear of fourteen days' Moose shooting in Canada, without requiring any change but socks; why then should we not profit by this knowledge, and learn to dress and equip our troops for a fourteen days' war? We should leave our knapsacks or bundles in charge of the Control Department during war, at any point we start from for fourteen days' real active work. Give us plenty of ammunition, some dried beef, biscuit, and preserved potatoes, not as rations, but merely to carry in the event of rations failing on any particular day, or on getting too far a-head to receive any. We might ease the soldier of half the weight of his present knapsack, and still give him extra ammunition, a light waterproof, a blanket, a pair of extra socks, reserve food, a piece of soap and a towel, taking care to distribute these *valuables* conveniently and judiciously on his person. I have not mentioned boots, because they could always be supplemented from the enemy or the killed.

I now come to the stumbling block of all advance parties, out-posts, skirmishers, and indeed of lines and squares—the supply of Ammunition. There is no part of our regimental system so incomplete; I therefore hope that my endeavour to meet the deficiency may prove acceptable.

I have here a small ammunition hand car, of my construction, which can supply 40 rounds per man to a subdivision (Plate xv, fig. 1). This car can be drawn with perfect ease by a pioneer, drummer, or bandsman, and does not occupy more than a man's standing ground in the ranks, in column, or in square. The revolutions of the wheels are registered on a dial, which indicates the distance marched by the subdivision, a considerable advantage, because places to advance or retreat upon, can be accurately measured and marked for the information of others; the cars, however, need not all be provided with registers.

If it be feared that some men will fire rapidly in action merely to get rid of the weight of their ammunition, here then is a remedy, because when a man knows that there is a reserve supply of ammunition at hand, to make good his "wilful waste," he will scarcely take the trouble to fire quicker than absolutely necessary. One of the great advantages of this mode of supply is, that men will feel more confidence when they know that they are *backed* by a reserve of ammunition, and have not to trust to being supplied by means of draught-animals led by cowardly muleteers.

The pioneers of the period when fully equipped are neither useful nor warlike; they seem strapped, buckled, and pinioned to pickaxes, crowbars, and knapsacks. I would relieve the pioneer of his burden, and carry more useful tools on the "hand-car," or give each man a small pickaxe or hoe on service, as the French have. The car should carry a few gun-spikes, some tourniquets, plaster, and bandages for the use of the sub-division.

These ammunition hand-cars would also serve as magazines to out-posts, picquets, trenches, &c.

During action the ammunition of the killed and wounded could be collected in them for future supply; after action they would serve to remove the dead and wounded.

Fig 2.

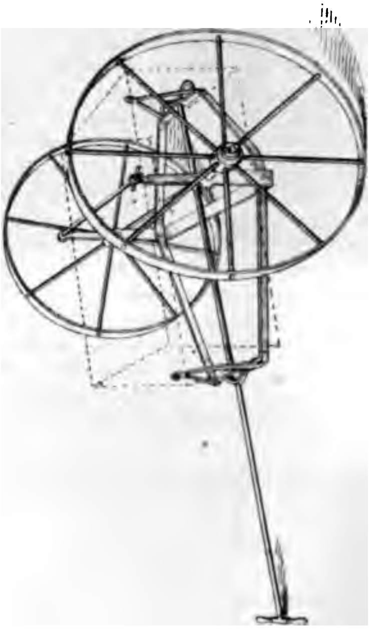
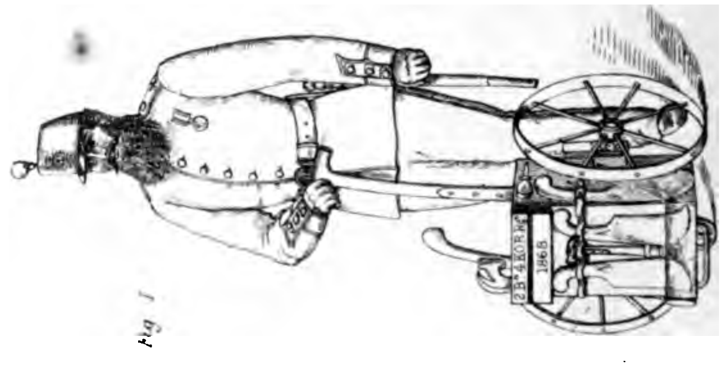


Fig 1



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In time of peace they could be used for the removal of ball ammunition to and from magazines, or for the issue or collection of blank ammunition. They would prove of great service in judging-distance-practice, reconnoitring, route marching, laying out lines for trenches, and bases for surveys.

Instead of ammunition, some of these cars might be used to carry intrenching tools, and one or two ought to be fitted with surgical implements and a few useful medicines, which might be the means of saving many valuable lives.

This ammunition-supply-car is of full size, has wrought iron wheels and axle, and is consequently not liable to injury from bullets. The handle by which it is drawn, is a pioneer's spade, the blade of which and the two bill-hooks protect the ammunition.

SKELETON AMMUNITION CAR.

I have also constructed a skeleton-car (Fig. 2), on which the ordinary regulation rifle-ammunition-case or box can be placed, the box forming the body of the car. A box of ammunition can thus be conveyed to any part of the field, and when delivered, the skeleton car be returned to the magazine for another box.

The ammunition should be packed, according to my method (see Plate xvi, fig. 1), in cases containing 720 or 880 rounds; one uniform size and shape should be decided upon, and the *cars* made to fit them. The lid of the box should be made to slide out, to save the trouble of breaking it open.

In an admirable paper read at our last meeting, on the subject of "Military Transport,"* everything desirable seemed to be provided for, except a safer means of supplying ammunition *during action* from the divisional and brigade stores, to the troops actually under fire.

We must still depend upon railways, waggons, &c., and sumpter animals for the conveyance of rifle ammunition *from* the base of operations *to the* field of action, but, arrived *there*, it must be halted, magazines formed at a safe distance from the enemy, and the supply beyond *that point* must be continued, as I have already said, by means of hand-cars.

A bundle of 10 rounds of rifle-ammunition weighs 1 pound 5 drachms, therefore a case containing 720 would weigh 73 lbs. 6 ozs., and 880 rounds 89 lbs. 11 ozs

Supposing one case to contain 880 rounds,

The weight of the cartridges would be	89 lbs.	11 ozs.
The box	5 ,,	
The car	40 ,,	
Total	134 ,,	11 ,,

About half the weight of the China ambulance barrow when *empty*.

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* See Journal, vol. xiii., page 263.

This barrow was adopted for the conveyance of wounded men. Its weight is 234 lbs., and allowing 154 lbs. (11 st.) for the weight of the wounded man, we have a total of 388 lbs.

If it was *really* intended that one man should push or pull this barrow, no complaints are likely to be made about the weight of my diminutive cars, and when we recollect that our old veterans used to carry 75 lbs. weight, without including rations, it is not difficult to believe that a man can pull or push *double that weight* on wheels.

If this skeleton-car be adopted for ammunition, I think the other car I previously described might be used, with *immense* advantage, to carry pioneers' tools, intrenching tools, medicines, and surgical appliances, which every man ought to be taught to use. I tried the experiment in the regiment I commanded, and every man in it knew how to dress and bandage wounds, set fractures, stop hemorrhage, and improvise stretchers, tourniquets, &c., &c.

AMMUNITION FOR THE SNIDER RIFLE.

It must be merely for the convenience of packing and to economise space that the "Boxer Ammunition" is done up in packages of *ten* cartridges placed alternately *Cap* to *Bullet* (see Plate xvi, fig. 2), an arrangement by which five percussion caps on each side of a package are liable to explode if hit, and the danger of explosion is terribly increased by the hard points of the bullets being placed, as they now are in kegs or boxes, in contact with the caps of the next package.

I have shown by several interesting tests, the damage which a small bullet, fired from a pistol into a box of rifle ammunition will produce, and proved beyond question, that the present mode of packing cartridges is the worst, and most dangerous that could be adopted.

The metal cylinders containing the powder are a great protection against spontaneous explosion, but a bullet fired into a pouch would cut through several cartridges, and all the loose powder would naturally blow up with sufficient force to burst the cylinders of the other rounds in the packages, cut into. I therefore beg to recommend:—

1st. That all cartridges as now packed, should be placed with the *exposed ends* of the packages towards the *top* and *bottom* of the pouch (Fig. 3), an arrangement which would considerably reduce the chances of explosion, because an accident could only happen from a shot being fired from a height into the top of the pouch, or by a piece of shell striking it from below.

2nd. As to the old pattern pouches, in which one of the compartments is too narrow to receive two packages with the cartridges *upright*, they should never carry more than three packages, *two* in the larger compartment, and *one* placed diagonally across the smaller.

The new pattern 50 round-pouch (Fig. 4), issued in 1866 to some Corps, has 5 compartments, too narrow to receive "Boxer's Ammunition"

Colˡ Martin's System
of packing Ammunition in a Case containing 880 Rounds

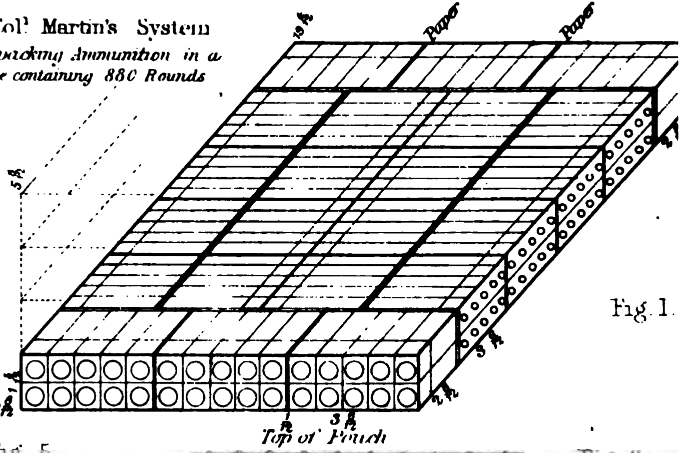


Fig. 1.

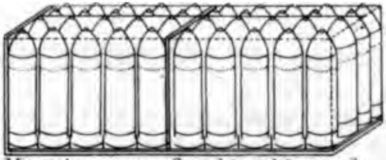
Fig 5

Colˡ Martin's Plan of squaring the

base of Cartridge

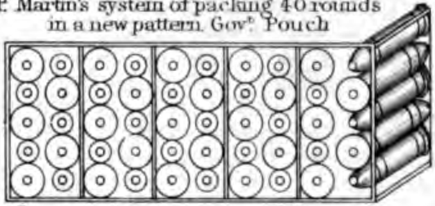
Fig 3

Rear view



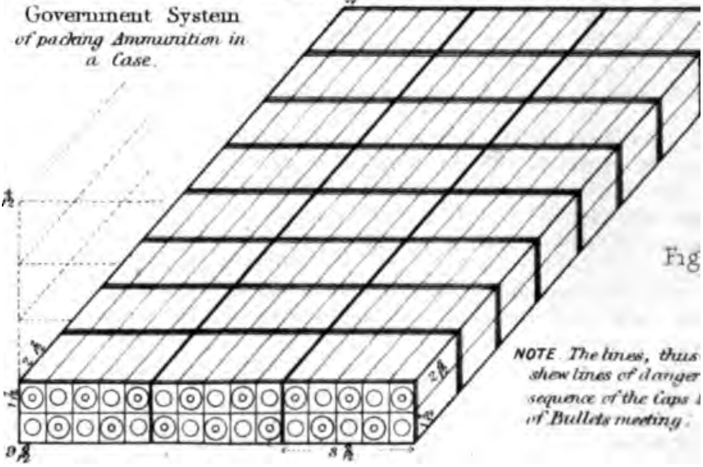
Colˡ Martin's system of packing 40 rounds in a new pattern Govᵗ Pouch

Fig 4



Government new pattern 50 rounds Pouch rear view 25 percᵗ Caps expoᵈ

Government System
of packing Ammunition in a Case.



Fig

NOTE. The lines, thus shew lines of danger sequence of the Caps of Bullets meeting.

placed cartridges *upright;* consequently the ammunition can only be stowed in the compartments *sideways*, that is with 25 percussion caps facing the *rear*, and subject to be struck whenever the soldier retires while skirmishing, or is faced about when manœuvring.

In order to remedy this most serious objection, instead of these 5 compartments for 50 rounds, the tins of these pouches should be altered to two longitudinal compartments for 40 rounds; and any extra ammunition that may be considered advisable for a soldier to carry in war-time should be arranged in "ball bags," according to a plan which has yet to be decided upon.

This only affects pouches; but kegs or boxes of rifle-ammunition would of course be as awfully liable to explode as they now are, because the caps *front* on two sides, at least, over the whole extent of the interior surfaces of any box or case they may be packed in, and this exclusive of the risk from a diagonal fire.

This danger admitted, I now propose packing the cartridges, with the caps or bases towards each other, and the bullets *outwards*, done up in packages of 10, 15, or 20 to suit new compartments in pouches (Figs. 1 and 3); for the simple reason, that as the caps are sunk in the metal where the "anvil" is, they would afford mutual protection, and the bullets being outwards, the caps could not be reached; moreover, if a bullet were fired sideways into a package, the cartridges would not be liable to explode as they now are. To make the bundles square for the convenience of packing, I also propose squaring off the projecting rims of the base disc of the cartridge which does not in the least prevent the certain action of the extractor at the breech block (Fig 5).

If the new Martini-rifle-cartridge which is longer, and weighs 9 grains more than the Snider is to be dealt with, the same method of packing can be applied, even if it be advisable to put 15 in one bundle, but the discs should be partially squared, and the new rifle extractor adapted to the arrangement.

With a view to rendering my small "Ammunition Supply Car," safe from explosion, I have at the gain of a little space, packed the ammunition according to my plan, and I am ready to *test* it with kegs or boxes packed according to the present system.

The great drawback in all campaigns has been the difficulty attendant upon supplying ammunition to detached parties while engaged, and I may not be far wrong in stating that this inconvenience has been felt from the early part of the 16th century up to 1868.

We are informed that during the late Prussian War, the want of ammunition for breech-loaders was not at all felt; this is not surprising, when we consider that the Prussians had it all their own way; but, if their enemy had also been armed with breech-loaders, the presumption is, that there would have been outcries for ammunition on both sides, and it is not improbable that some of the engagements would have been concluded with the bayonet.

We may safely infer from what we know of breech-loaders, that in the next European War, the Army best supplied with ammunition.

and the means for intrenching at its most advanced posts, will have the best chance of success.

It is very remarkable how little we have improved since the Peninsular War, in the supply of ammunition by day to troops under fire. Then, as now, mules or horses were laden with two or three kegs of ammunition tied on pack-saddles; a muleteer was sent to the front in charge of two animals, and soldiers were frequently told off to aim at him until his load was deposited; arrived at the first batch of troops he let the kegs fall and made off. The kegs were then broken open with the butts of muskets, the ammunition required was appropriated, and the remainder left on the field; and we have often been told by old warriors that kegs upon kegs of ammunition were deserted for want of transport when an advance was ordered, and that they had frequently to hold their ground without a cartridge in their pouches.

The heroes of Inkerman, armed with the old fashioned muzzle-loader, after expending their ammunition, had to fight with the butts of their muskets, stones, and the toes of their boots; and at the Redan it was impracticable to convey ammunition to the active front on account of the broken ground.

Here then are instances which come nearer to us, and which might occur again to-morrow, when carts and horses and sumpter animals would more certainly fail us, not from lack of men "stalwart and true" always ready to drive them, but because armed as all European troops *now* are, we should be merely driving our cattle to certain destruction.

The lesson we have to learn from all wars up to the present time, not even excepting that in Abyssinia, is, that we must not depend solely upon draught or sumpter animals, but render our troops independent, by providing for them a convenient means of conveying with them at *all times*, and under *all circumstances*, a *reserve of ammunition.*

I have been asked, how my "Supply-car" would act in ploughed land? I reply, that it will be found to act better than any other known means of supply, and will cost considerably less. Mules or horses laden with ammunition sink into the soil, they frequently break down and the men who lead them, have to load and re-load them, and have often to lighten the burden by casting away a keg or two of ammunition; again, the animals and the men have not only to be fed, but both become grievous impediments, the moment their load is delivered, or lost, and if our present system be persevered in, and our ammunition packed as it now is, we shall find our military-transport carts, men, horses, and sumpter mules blown up, or shot down, simply because they would become a mark for the enemy.

The disadvantage of supplying ammunition to troops *under action* by means of horses or mules is manifest from the fact, that the man or the mule, or both, may become wounded or shot and the ammunition lost, or sufficient explosion might take place to cause the animal to cast his load and become unmanageable.

My "Supply-car" is so small, that it is not likely to attract the enemy's attention; its wheels are sufficiently broad to enable it to be *drawn* easily over ploughed land. The pioneer, in light marching order, in charge of the "Supply-car," assisted by a drummer or bandsman, would keep pace with the men of the sub-division; for it must be borne in mind that the men have to march heavily laden over the same ground; moreover, the car being so small and handy can be lifted on to narrow pathways, or over ditches and obstacles, and being perfectly water-tight, can be drawn through rivers or streams by means of the rope attached to it. Supposing the pioneer and the drummer or bandsman to be shot or wounded, the rest of the subdivision would take care not to desert their car, and many hands would make light work; on level ground a drummer could draw it for miles. Women propel far heavier burdens all day long on our pavements and highways; and young girls may be seen during the potatoe crop wheeling greater weights in common wheelbarrows through ploughed fields. What these can do in their daily avocations ought not to be considered too much for soldiers on emergency.

It would be interesting if we could ascertain how much of our national debt is attributable to losses in mules and horses, and unexpended ammunition supplied during action. If our loss was considerable in days of flint locks and short ranges, what will it be now, under the same supply-system, with a rifle ranging with deadly precision to above 1,000 yards, and capable of unloading seven mules in a minute? If we can bring ourselves to sufficient perfection to make our seven shots tell, we may be sure our European enemy, if we ever have one again, will be able to compete with us in long ranges at substantial marks.

The transport of ammunition on mules, &c., or in waggons by day, should now cease when within a safe distance from the enemy's fire, and depôts should be formed whence to replenish men's pouches and re-fill the "supply cars" of regiments. The regulation barrel of ammunition contains 760 rounds; a mule with two such barrels would therefore carry 1520 rounds. My "Supply car" contains 880 rounds, consequently one car to each subdivision would give 17,600 rounds per regiment, carried free of all expense, except the trifling cost of the cars, there being 10 pioneers, 20 bandsmen, 10 drummers, and 10 fifers, really non-effective in action, to take charge of them, not including the men who might be enlisted instead of muleteers.

The advantage in the way of economy alone, of my system must become acknowledged when the following facts are taken into consideration:—

1st. The immense expense attendant upon the purchase, transport, feeding, shoeing, and extra commissariat carriage for forage, say for 17 mules per regiment, 12 being required to carry conveniently 17,600 rounds in barrels on heavy pack saddles, and 5 in reserve.

2nd. The paying, rationing, &c., &c., of the veterinary surgeons, and at least 16 men for conducting and keeping the mules, besides farriers, forges, tools, &c., for shoeing and for repairing pack saddles.

3rd. When troops are moved by rail on any sudden emergency in war time, sumpter animals and their conductors, forage, pack-saddles, barrels of ammunition, &c., have all to be stowed in different parts of the train, thus causing endless confusion and delay. Arrived at its destination, the train has to be unloaded, mules dragged out, pack-saddles and ammunition searched for and fastened on, whereas my diminutive cars can be run in and out of railway carriages without being unpacked, and on the line of march they can be lifted over walls or any other obstacles impracticable to mules.

All we have ever read in history fails to afford us an idea of what our future battles will be; common sense, and common sense only, must guide us, taking our data from the knowledge we have of our weapons, and the good use our soldiers can make of them. We must be careful that every possible provision be made to imbue the soldier with confidence; and the best way to effect this is, to let him know that he has an extra supply of cartridges at hand, and has not to trust entirely to being relieved by supports before he can honourably quit his post. It was with a view to this that I improvised my "Supply-car," and in making it also carry the means of preserving life, spiking guns, and the tools necessary for removing obstacles, cutting wood, and entrenching, I have added not a little to the safety of the men; and as in retreating, it will mark fairly the distance from an object, we shall be able to adjust our rifles all the more accurately when we make a "stand;" last, not least, if the car be fired into, the cartridges packed according to my system, will not explode.

Our future fights will never again exceed the best portion of a day, and more than sufficient for that day will be the evil thereof, if we go not forth lightly equipped and our pouches and canteens heavily laden. We are prone to depend so much on "pluck" that we are often improvident in our arrangements, but if we should ever require to display our national gift to its greatest advantage in the field, the soldier must become his own mule, muleteer, doctor, cook, and engineer.

MILITARY INVENTIONS.

How is it that we, who as a nation are considered so supremely *practical*, seldom seize upon a military idea or a military invention *of our own*, until it has been returned to us Frenchified, Prussianized, or introduced to us as *the very* last Yankee notion?

The fact is, military inventions are not encouraged. Inventors have many difficulties to overcome, and are not much assisted by those who have it in their power to protect them.

1stly. By increasing the practical utility of this "unique" Institution, and *making it at once* what it is struggling hard to *make itself*, and 2dly, by protecting *bonâ fide* British *military* inventions and improvements, and affording facilities for *fairly testing them* without favour or affection, *not* cavilling at *expressions*, but entering fully into the real merits of the invention, persons would be saved the expense of *patenting* inventions that can only be taken up by Government. I can venture to speak with some degree of *experience* on these matters, because I have suffered losses from piracy on several occasions when my duties called me from one *end* of the world to the *other*, and I became practically acquainted with the *fact* that the *equilibrium* of our charming planet is not *in the least* disturbed by *any preponderance* of honesty at *either end*.

Among other things my "war-truck" now called by the Americans the Requa Battery and *réchaufféed* by the French into the "*mitrailleur*," was made by me at Aden in 1860, when I saw in the Journal of this Institution that it was proposed to fortify London, but that the enterprise was likely to fail because there would be difficulty in procuring sufficient men to furnish three reliefs to the enormous works in the event of an invasion. I provisionally patented the "war-truck," and presented it to Government in January, 1861, as I was about to start for India again. My duty called me to Canada seven years after, and on making a tour in the United States, I saw my "war-truck" ready for use at West Point Academy, New York, and another at Niagara Bridge, imitated in everything but its diverging fire, which my American friends did not perceive was one of its main features; and I can, I am sorry to say, instance other similar transactions which have compelled me to have recourse to the expense of completing my patents.

Select Committees are so very liable to "*disestablishment*," and have so little time to wade through the proceedings of their predecessors in office, that many useful things are lost sight of. May we not therefore hope that this Institution will yet become the official custodian of our war appliances, and consequently of our individual interests in relation to military inventions?

Colonel MARTIN then exhibited and described his "war truck," and "rifle battery," invented in 1860.

The CHAIRMAN: How many rounds will your supply car carry?

Colonel MARTIN: This is made for 1,000 rounds. But I should prefer 880 rounds, packed in 88 bundles, because we can pack 880 rounds in it so that they will not explode. The authorities at Woolwich have tried, and they could not explode my packages in pouches. The 88 bundles weigh 89 lbs.; therefore, there are 89 lbs. in the cart besides the tools. Two or three of these carts *without ammunition* would suffice to carry all the extra pioneer and entrenching tools of a regiment.

The CHAIRMAN: Is this for one pioneer?

Colonel MARTIN: For one pioneer; but up or down hill a drummer-boy would assist him.

The CHAIRMAN: What is the diameter of the wheels?

Colonel MARTIN: These are 2 feet 4 inches; but I would make them two or three inches higher, because the cars would then be easier to draw. In the "skeleton car" the centre of gravity is below the wheels. If the other car is considered too heavy with these tools on it, I would adapt it for nothing else but entrenching tools, and make them carry tools up to 2 cwt.

The CHAIRMAN: The tools for the pioneers?

Colonel MARTIN: For the pioneers. Then, let the drummer-boys and the bandsmen, and the men who would otherwise be employed as muleteers, have "skeleton cars."

The CHAIRMAN: The subject that has been mooted is a very interesting one, the supply of ammunition in the field particularly. I dare say there are some gentlemen who would wish to make remarks upon the feasibility of Colonel Martin's proposal.

Major McGuire, 1st Royals: I think there is an inconvenience in having the handle removable in this supply car?

Colonel Martin: That is for carrying entrenching tools, and I have made the spade serve for a handle, for the simple reason that a handle would weigh something, and it is desirable to save weight. But with these straps I can also draw the car. In going up or down hill I can also block the wheels, thus, with them; and if I want to lower the car into trenches, or into deep ditches, there is a rope attached by which I can do it. The spade or handle is easily put on by means of this clasp and hook, and the "jemmy," can be attached firmly to it in an instant. You need not take off the handle unless you like, but if you found yourself in a plain, you could make it useful as an entrenching tool. Everything on the cart I have endeavoured to make useful.

The Chairman: How many pioneers did you say?

Colonel Martin: Ten pioneers. Then, there are all the bandsmen and all the muleteers. If you do not have this car you would require a muleteer and a mule.

The Chairman: The question with regard to horses carrying ammunition is, whether a horse cannot carry a greater supply of ammunition to any place where you want it, than man's labour can.

Colonel Martin: The answer to that is, Which is most liable to be shot?

The Chairman: Quits as to that, I should say.

Colonel Martin: Because, in one case you have got the muleteer and the mule, two lives. You cannot have a mule without a muleteer.

The Chairman: But you can put 2,000 rounds of ammunition on the mule.

Colonel Martin: But you have got a man and a mule. If the man is shot the mule is of no use; and if the mule is shot, the man is of no use, and you lose your 2,000 rounds of ammunition. This is the way I argue, *the loss ensues, whichever life* is lost. Then again, you have *two* to feed instead of *one*. Whereas, in my case, if the man is shot, the car does not run away; another man can go for it and pull it back, or take it forward. There are always plenty of men in the field.

The Chairman: Do you think you can use that car in deep ground?

Colonel Martin: Yes, particularly the skeleton car, because I have made the wheels half way up the box, and the gravity is below the wheels, so that it cannot upset.

Captain Burgess: Will you show the car turned upside down?

Colonel Martin: Yes. Supposing it to tumble over going down hill, I could drag it just the same.

Captain Burgess: And you can turn it round on a pivot?

Colonel Martin: Yes. It does not require its own length to turn it in. I have a pivot here, and it turns on that pivot.

The Chairman: That car holds 1,000 rounds in one box?

Colonel Martin: It holds 880 rounds, which is all the ammunition I want to be packed. That is the safest way it can be packed; it can never explode. During the six years I commanded a regiment, I felt the want of something of this kind; but it was not until lately that I became aware that the new ammunition, as now packed, was so extremely liable to explode, and during the late Irish elections I took upon myself to alter the position of the packages in the men's pouches. I then thought how imperfect my car would be if the ammunition in it were packed according to the present system, and I hit upon the plan I now show you.

Captain Burgess: Have you practically tried it?

Colonel Martin: I have practically tried it. Every one of the Woolwich pouches blew up, but not one of mine.

The Chairman: The cartridges you exhibit were fired at from the outside?

Colonel Martin: These were fired at in pouches packed according to my plan.

Mr. Stirling Lacon: Have the Government recognized it?

Colonel Martin: Yes, they have thanked me for it. Here is the Government pouch, and here is mine. My danger is from below; but the pouch is not likely to be struck from below. It is a simple arrangement, and I think it a safe one.

The Chairman: Will you alter the outside of the pouch?

Colonel Martin: Yes; they will all have to be altered, just as they will have to be altered for the Henry-Martini cartridge.

Major MacGuire: You will not have to alter the rifle for the cartridge with the square base?

Colonel Martin: No.

The Chairman: As possibly no other remarks will be made, I may say that we are very much obliged to you, Colonel Martin, for coming here to give us this practical explanation of your inventions. Of course, there will always be differences of opinion as to whether inventions of this kind are completely applicable in the field. There is no doubt that discussions on them are of the greatest possible interest; and there is no doubt as to the ingenious and serviceable adaptation of your inventions, as you have shown us this evening.

Evening Meeting.

Wednesday, May 5th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

SHIP-RAISING; ESPECIALLY WITH REFERENCE TO HIS EXPERIENCE IN RAISING THE RUSSIAN SHIPS SUNK IN THE HARBOUR OF SEVASTOPOL.

By COLONEL JOHN E. GOWEN, U.S. Army.

MR. CHAIRMAN AND GENTLEMEN,

It was with no small diffidence that I accepted the invitation with which your distinguished Society honoured me to read a paper to-night on my experience in raising sunken vessels, but I feel sure you will accord me your indulgence and consideration, when I tell you that it is the first time I have lectured on this or any other subject, and you will agree with me on the wide difference between such a position and the conduct of those submarine operations to which the greater portion of my life has been devoted.

From time immemorial, the process of raising vessels in a tideway by means of the rise and fall of the tide has been considered the only certain method of effecting that end, and my system is purely a scientific application of the principle therein involved, with the exception that I am independent of the tide.

It is not my intention here, to enter very fully into the various schemes which have been brought forward, some partially successful, some totally impracticable, and others never yet tested; but for a number of years the question has been one of the greatest interest to me, and I think there are but few, if any of the tested or suggested processes which have not come under my observation, while many of them I have myself employed with varied results.

About the year 1849 an invention was submitted to the United States' Government, having for its object the raising of vessels by means of air-tight cases composed of several thicknesses of canvas and india-rubber, with a strong netting on the outside. On a trial which took place with a view of ascertaining the value of this invention, as a means of carrying a vessel over a river's bar, it is notable that a sloop of war in Baltimore having a number of cases attached, (if I recollect 20 on either side) was only raised some 18 inches on their inflation. Government, however, purchased the apparatus, and subsequently discovered that for the intended purpose (viz., the raising of submerged vessels), the method was a complete failure. I shall further on have to refer to a case in which I also experienced the same results with it.

Other and very costly apparatus has been designed, principally one or more, for raising by powerful hydraulic pressure; but I am not aware that either of such modes has been practically tested, and those I have seen in model are open to serious objections for practical working, though in theory, they are all that may be desired.

Bishop's Floating Derrick, and its failure, is doubtless fresh in the recollection of all here, though it may not be known, that prior to its introduction into this country, it was tried in the United States; but as I before said, my intention does not lie, even if time permitted towards criticism on others' schemes, but rather to lay before this Institution some of my experience, and an explanatory statement of the method, which after a long course of disheartening failures and difficulties overcome, enabled me to achieve most perfect success.

About the year 1845, the United States steam frigate "Missouri" was burnt, and sunk in the Bay of Gibraltar, causing an obstruction, which was the subject of complaint by the British Government. On its representation, the United States' Government undertook to remove her, and in various attempts expended no less a sum than £20,000 without success, the Engineers reporting it was impossible by human ingenuity to effect the desired end, and in 1851, on a second application from the British Government, it was resolved to make a further attempt, and I was honoured with a commission to carry out the operation.

I found the vessel (a first-class war steamer) sunk in about 6 fathoms, and laid over broad on the bilge, having about 3 fathoms clear over all, and completely covered with sand. Government had forwarded 20 of the before-named air bags for me to test, which I accordingly did, and succeeded most effectually in bursting up the greater portion of them without getting an aggregate lifting capacity of 9 tons, and this happened generally before they were half inflated, though each bag was supposed to be equal to more than 5 tons. I concluded that the only effectual means of removing this vessel was by exploding gunpowder beneath her keel, and the process I adopted was as follows:—

I had constructed pointed cast-iron cylinders some 7 feet in length 14 inches in diameter, and 1¼ inches in thickness, having about 3 turns of a screw cast on the point (similar to a screw-pile) filled with gunpowder, and closed by caps secured with screw-bolts. These cylinders were placed outside the vessel in such a manner, that on being driven through the sand some 30 feet, they would arrive beneath the vessel's keel. To effect this, I used a shaft of wrought-iron constructed to fit over the head of the cylinder. This shaft worked from a raft on the surface of the water, and was turned down in the same manner as the screw-pile now in use, so that by its means the cylinders were placed in the required position, and the shaft being removed, were exploded by electricity. The vessel was in this manner broken up, raised piecemeal, and I received a certificate from the British authorities that the obstruction was cleared to their entire satisfaction.

Shortly after this, in the year 1854, my attention was called to the steam-ship "Erie," burnt and sunk with great loss of life on the Lake of that name. She lay in about 10 fathoms, and several attempts had been made to raise her, amongst others, one by "Bishop's Floating Derrick," before referred to. Report alleged that the vessel contained about £75,000 in specie, and thousands of pounds had been spent in endeavouring to raise her, but up to that time without success.

It appeared to me, however, to be anything but a hopeless case, and with very little difficulty, I succeeded in raising her entire by means of chain-falls working from two open trussed frames, the ends resting on hulks on either side, and towing her into Buffalo Creek, hauled her ashore, and cleared out the contents, from which I recovered £1,000 in silver, and a mass of amalgamated metal, supposed to be gold and silver, which appeared to promise so rich a harvest, that I refused an offer of £10,000 for one-half share. Taking the metal to New York, it was submitted to assay, and I was informed six days would be necessary to make the investigation; on the day appointed, however, when I attended with some friends to learn the extent of my good fortune, to my surprise and dismay, I found that the result of the assayers' six days labour was the production of two small bars of silver, value in all about £145, and that my gold was transmuted into the less precious, though useful metals, which had composed the connections and fittings of the engine of the sunken vessel.

Did time permit, I would call your attention to various other experiences prior to my undertaking the operations in Sevastopol Harbour, but as this is more especially the subject on which I have the honour to appear before you this evening, I will now proceed with it.

In the year 1856, I received a communication from the Russian Minister at Washington, to the effect, that his Government wished to negotiate with me for raising the sunken fleet at Sevastopol, and on this invitation, I at once proceeded to Moscow, and had an audience through Prince Gortchakoff, with the Grand Duke Constantine, who requested my views upon the practicability of clearing the harbour of the numerous obstructions which the policy of the Russian Government had created. Having previously given the matter most serious reflection, and decided upon the only plan which, to my mind, bore a probability of success, I showed his Imperial Highness plans of caissons somewhat similar to those exhibited this evening, and he at once desired that I would undertake the work. Acquaintance with the difficulties surrounding such a task, increased the hesitation I felt in undertaking at all a labour of such magnitude, but ultimately on the representations of the Government, I accepted the contract, on terms subsequently materially differed from (resulting on account between us in a balance of about £50,000 in my favour, which I fear will never be liquidated); and in the spring of 1857 I arrived at the scene of those operations, which were to extend over the five succeeding years.

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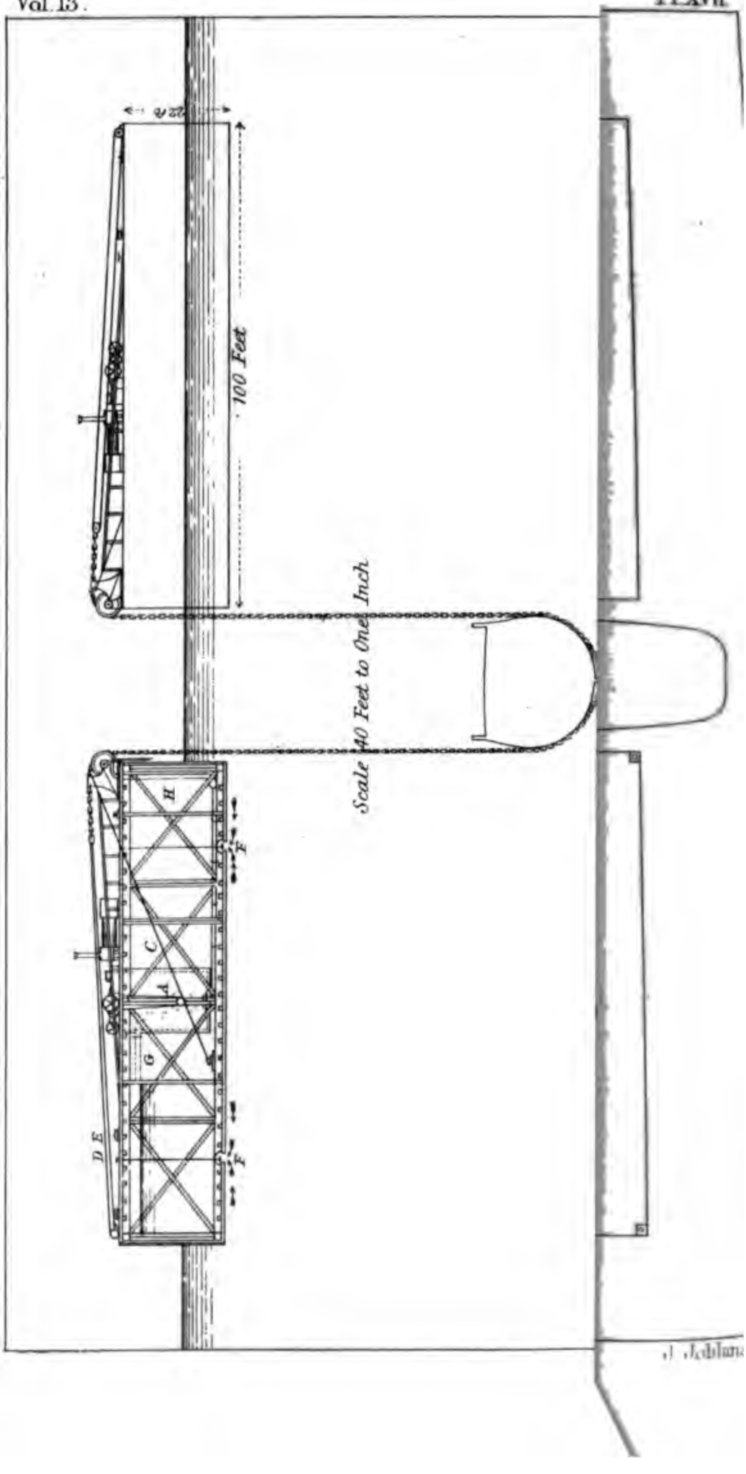
Pl. XVII.



Though, doubtless, many here have a personal knowledge of the rbour and roadstead of Sevastopol, I will, for the information of ose unacquainted with them, exhibit a rough sketch showing also e positions held by the sunken vessels, which, I may here state, re found to be imbedded in an average depth of about 19 feet of d, clay, gravel, and shells; in some instances reaching a depth of feet.

Making no comment upon the many theories propounded on the bject before us, but confining myself simply to a statement of my stem and its results, I will at once proceed to an explanation of the pliances I used.

In the first place, I had intended to use four caissons on a smaller ale than those shown in the diagrams, to which I shall shortly call ur attention, and I may be better understood when I state that on ing tested, these four caissons had an equal lifting capacity with two those I am about to refer to. The material for their construction I ought with me from America, and they were designed to lift by chains rough centre well-holes, on which principle my first attempt was ade. It was obvious to me that such a process must bring the issons together as the vessel rose, but I trusted by the use of heavy chors to keep them apart, and was scarcely prepared for the result. the vessel lifted I found no means which I could adopt, would event the caissons closing, and when so closed, no power could start em, although I had at my command powerful steam craft, gunboats, c. These I employed without the slightest success, never, in any stance, being able to get one inch of division, even when using steam ssels of 700 united horse-power.

Here was a grave difficulty, and in addition to this, doubts arose hether I had sufficient lifting power to compass the end in view. I ight raise a vessel until the broken masts and top hamper touched the isson's bottom, but could never hope to bring her to the surface; d, in the first instance, it must be understood that I was working on the smaller vessels.

I determined, therefore, while altering the caissons in use, to nstruct two others, having a lifting capacity equal to the four smaller es, and for this purpose had to go some hundreds of miles into the untry to cut the necessary timber.

Suspending all raising operations until the new caissons were com-eted, I took the field with the six, and if you will kindly follow e to the diagrams, I will explain in some detail their construction, king one of the larger ones for illustration.

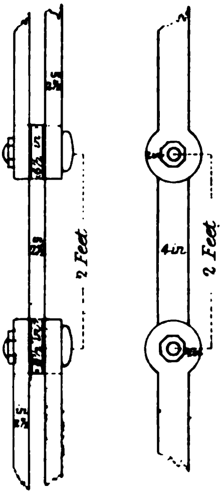
The outside shell of the caissons (Plate xvii) was constructed timber, zinced on bottom and sides up to three feet, and divided to six water-tight compartments, in the centre ones of which was e well or pump chamber, marked A on the diagram. This frame-ork was braced with trussed or open girders in such a manner s to give the whole structure the greatest strength and rigidity onsistent with maintaining the necessary buoyancy and distributing e strain when engaged in lifting over the whole area of the aissons. The cast-iron wheels over which the lifting-chain passed, it will be seen, were also braced and supported by the iron bar C in the diagram. Each caisson was provided with a portable engine of 15-horse power to work the powerful centrifugal pump in the pump-chamber A, as also the winch above, to which the falls D, E, were taken. At the points marked F, F in the diagram are shown the valves for the admission of water, which were worked by means of spindles as shown, reaching to the deck and opened or closed by a key-wrench. Between each compartment were sluice valves admitting the water to flow equally into such of the compartments as might be necessary. The pipe G led from the pump through the side of the centre compartment for the expulsion of water, while that marked H connected the pump with the hose used, as hereafter referred to, for pumping out the vessel when raised.

In raising weights of less than 1,000 tons, I rarely needed to submerge the caissons, but admitting water into the after-compartments to act as a counterpoise, I could with ease run such burdens to the surface by means of the five-part fall, hooked on to the lifting chain, and taken to the steam winch. The majority of the vessels, however, which I raised, being of far greater weight, the process I adopted for them was as follows, by which mode I had a lifting capacity of over 5,000 tons.

Pre-supposing that the caissons were moored in proper position above the sunken vessel, and the lifting-chains passed beneath the bottom (which process I will hereafter explain), the valves at F and the sluice-valves were opened, and water freely admitted into all compartments till the caissons were submerged to within a few inches of the surface of the water. All valves were then closed, the chains hauled taut by the falls, and water being retained as before in the after-compartments, that in the fore-compartments was expelled by pumping, the vessel was correspondingly raised, taken in tow to shoal water together with the caissons, till she grounded, when the operation was repeated, until the deck came above the surface, all leakages were then roughly stopped, and the hoses leading from the pipes H passed into the vessel, and the pump set to work till she floated, and allowed me to clear out the accumulated mud, rubbish, and ballast. It will be seen that if at any time there was an uneven strain on either of the chains, the caisson would immediately cant, giving an opportunity of re-adjustment before such chain could part.

With the chains lay the great difficulty; the ordinary chain-cable of familiar form was, as I knew, from former experience, of no avail, invariably when subjected to a heavy strain drawing out and crushing the stud, and when I commenced operations it was with a chain consisting of solid iron links, each 2 feet in length, pinned together in a manner not unlike the chain which passes round the drum of a watch. This chain, as shown in Fig. 3, plate xviii, was manufactured of best American iron, 2 inches thick by 4 inches in width, and connected by a 3-inch steel pin; with it I was partially successful, but after parting it like pack-thread, more than 100 times, I concluded it would be necessary to procure some other chain capable of resisting the heaviest strain which I could expect to meet with. I accordingly designed the chain

Fig. 3.



Scale 2 Feet to 1 Inch.

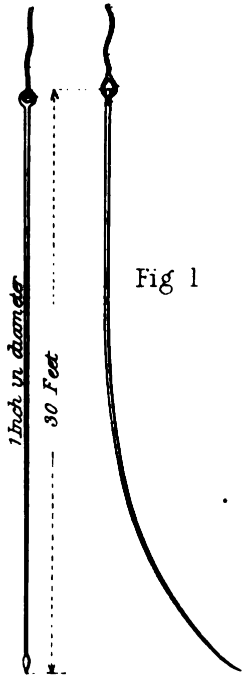
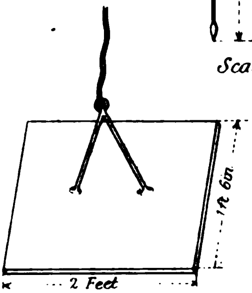


Fig 1

Scale 10 Feet to 1 Inch

Fig 2.



Scale 2 Feet to 1 Inch

Fig. 4

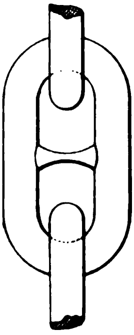
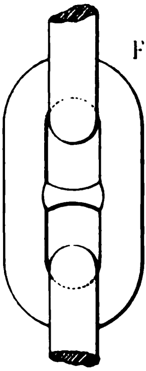


Fig 5



Scale 1¼ Ins to a Foot

shown in the diagram, the smaller (Fig. 4) being for use on the lesser caissons. The larger (Fig. 5) was probably the heaviest chain in use up to that time, and its links, it will be seen, are constructed with only a sixteenth of an inch play on either side, the sides being parallel. I was, of course, obliged to send to England for this to be made, and forwarded the design through my agent to Messrs. Brown, Lennox, and Co., with instructions to manufacture it of Low Moor Iron. They, however, telegraphed me that the form of chain was bad, and it ought not to be made of Low Moor Iron. Considering myself the best judge from experience on both these points, I could only reiterate my instruction, and at last received the chain as ordered. It answered completely, never parting in a single instance, and the form, I believe, is now in use to some considerable extent.

And now to refer to what doubtless is a matter of some curiosity on the part of every one, and was to me, I can assure you, the greatest difficulty encountered, namely, the slinging of the vessels.

I had secured enormous lifting-power, which, for a long time, bid fair to be useless through my inability to connect it with the weight to be raised. Every method of slinging I tried, without success, and it is only those who have had practical experience with the subject, who can form an adequate idea of the difficulty of working ponderous chains of the character used.

It has been my lot, more than once, in conversation with gentlemen interested in this question and owning inventions of more or less merit, to hear them say, "I should pass this chain *here* or *there*," as if they were speaking of a watch-chain. Why, when one considers that each link of such a chain as must be used in these operations, weighs nearly a hundred weight, the "passing" referred to, is a process that I venture to say, among theoretical projectors, has in no case received the attention it demands, but is too often taken for granted; and such gentlemen start off on their theory with the vessel slung, when that is the point at which they should commence. This suggests to me that possibly I should have explained *my* method of slinging in an earlier part of this lecture. But again I have to ask your indulgence for reasons before stated.

On every attempt to sling, either by sweeping or girdling the vessel, the chains parted, or slipped; when I led the chains through the ports, they cut up through everything; I then had recourse to the following expedient upon a 60-gun frigate.

With the difficulty necessarily attending such work, conducted at a depth of some 60 feet below the surface of the water, I succeeded in cutting four holes through on either side of the vessel below the orlop-deck, about 16 inches in diameter, and after crowning the same with one-inch boiler-plate, passed the lifting chain through the apertures, hauled taut, and attempted to weigh the vessel. The chains cut up through everything, and thus another failure was registered.

I was now convinced that the only method which would answer, was bottom-slinging, and, turning my attention in that direction, succeeded at length by the following simple method, in placing chains with the greatest success and expedition beneath every vessel on which I subsequently operated :—

Fig. 2 shows a flat iron scraper, on about ½ scale, about 2 feet in width and 18 inches in depth, composed of ¼-inch-plate iron to which a strong iron-handle is riveted.

To this handle was made fast a rope, taken to a capstan in a vessel moored alongside, and the diver, having adjusted it against the vessel's side at a point where the chains were required to be passed, it was drawn away from above through the mud, re-adjusted, and re-drawn until a channel was made following the vessel's side to within a short distance of the keel. The diver then made use of a long curved, flat-pointed iron rod (Fig. 1), having an eye in the head through which passed an inch rope. This he pushed under the vessel's keel, and it was drawn through from the other side by the diver occupying the corresponding channel.

In this manner a way was opened for the introduction of small chains, and ultimately of the heavy lifting-chains used, which were hauled through from above.

This, which threatened to prove an insurmountable obstacle, was thus overcome, and from that time I experienced no other difficulty than occasional bad weather.

It must be remembered that the whole of the operations were conducted in an exposed position with no tideway. Here, however, is shown a great feature in the system. The caissons, when in use in heavy weather, had only to be submerged where moored, and thus would ride out any gale of wind; and during the whole of the time I never experienced an accident to one of them. With equal facility they were towed even in fresh weather, corner-on in line, and it was only during the frequent heavy gales that operations were suspended.

A few remarks upon the undertaking generally may not be uninteresting. Immediately after the battle of the Alma, the first line of vessels was sunk, all-standing, between forts Constantine and Alexander. The terrific gale subsequently, when so many of your transport vessels were lost and damaged, cleared away all those parts of the masts and rigging which had previously shown above or near the surface of the water.

These vessels had been sunk with all their guns, but in only one instance was this the case in the subsequent sinkings.

The authorities, after sinking the first line of vessels, had the batteries of the remainder of the Fleet removed, replacing them with large blocks of stone of equal weight, the guns so removed, going towards the equipment of the fortifications on the land side.

On preliminary investigation of the sunken fleet, it was found that the teredo had made fearful ravages in the upper works of the wooden vessels, that timber only having escaped, which had been covered or coated with mud. The extent to which this pest of those waters had completely honeycombed every inch but what had been protected, would have appeared to me almost incredible, had I not been an eye witness of it. Specimens of timber containing the teredo were forwarded by me to the Russian Government, and I believe are now shown in the Museum at St. Petersburgh, and in other museums throughout Russia. During my stay in Sevastopol, two blocks of wood were forwarded for me to test, one coated with a composition which it was asserted would defy even the teredos' attack; but after four months' submersion I found each equally perforated. The maker of the composition in England troubled himself to write me several letters on the subject, urging me to state to Government the result of the test; finding he would not otherwise be satisfied, I was compelled to make what could not be other than an unfavourable report of his composition.

I was especially successful in the raising of the iron vessels. In the case of the war steamer "Elbooroos," which was docked, even the paint was in order, save where the chains had chafed, and the vessel is now in commission as the yacht of Her Imperial Majesty the Empress of Russia.

While raising another iron war-steamer, the "Danube," I found it necessary to apply the lifting power rather far out towards the stern and bows, in order to avoid the paddle-boxes, but on attempting to raise her, the bow and stern made their appearance on either side, and, finding there was no possibility of raising her entire, I adopted a novel expedient, and by taking advantage of the experience gained through prior calamities, cut her up in half, and having constructed coffer-dams, puddled with clay, raised her in two pieces, which parts were floating about my works subsequently for at least three years. In all I raised and cleared over sixty vessels from the roadstead and harbour, 27 entire, the rest being so badly burnt that they broke in raising, and came up in pieces.

In conclusion, and trusting that I have made myself understood in this brief reading, I must express my surprise that no perfect system of salvage exists in this country, and that day by day, valuable vessels are lost and allowed to go to pieces often without an attempt to raise them. In New York, Boston, and other places, my process is in use, or about to be used, and it is my wish to introduce it into this country, feeling sure, that even as a commercial transaction it will pay handsomely. Turning only to the past year, and close at home, we see the "Foyle" sunk in the Thames, and given up after various attempts as a hopeless loss; the "Leichardt," run down at the Nore; the "Florence," off the Isle of Wight; together with many other vessels which were easily reclaimable, had proper appliances been at hand.

Should caissons be constructed in this country, great advantage would be gained by using iron throughout, and various other improvements have also suggested themselves to me which would perfect them. I am convinced by the experience which I have this evening endeavoured faintly to shadow to you, that no better process is extant; with it, a certainty has been achieved, and I may be pardoned for the foregoing confident assertion, when reflecting that no perfect success under equal difficulties has ever yet resulted from operations carried on for the raising of sunken vessels, while we all know the fabulous sums expended in futile attempts.

It is a startling anomaly that the greatest maritime nation of the world is absolutely destitute of any certain appliance for the salvage of sunken property.

I have laboured this evening under considerable difficulty in attempting to give you an outline of my "experience;" but if I have been enabled to afford you any interest I am amply repaid for accepting the, *to me*, novel position of a lecturer.

The CHAIRMAN: Would any gentleman like to ask Colonel Gowen any question upon this subject, so as to elucidate the matter further. I am sure the Colonel will be very glad to give us any further information that he can.

Colonel GOWEN: Very gladly. Here are different specimens of wood that have been under water a considerable time, showing the effect of the *teredo*. This first specimen, I believe, is a portion of the steering wheel of the "Twelve Apostles," and the worm has produced upon it most astonishing effects; I could hardly believe them myself. I have collected for the Russian Government, and preserved in alcohol, specimens of the *teredo*, that were one and a quarter inches in diameter. Here is a piece of wood that has been submerged 167 years. It is a portion of the gun-wheel of one of the French vessels sunk in the harbour of Vigo in 1702. The *teredo* has made considerable havoc on this. The wood is otherwise as sound as when it was first manufactured into a wheel.

Captain BURGESS: Perhaps Colonel Gowen would describe the teredo, and how it works?

Colonel GOWEN: The body seems to be composed of mucilage; the head is a species of shell, very hard indeed, pointed not unlike an ordinary auger. The length of its body, I should think, is about twenty times its diameter. The hole which it makes in entering the wood is scarcely perceptible, not much larger than the point of a cambric needle. As you see here, the inside of the perforation is as smooth as possible, much more so than could be effected by mechanical means.

The CHAIRMAN: Do the chambers run into each other?

Colonel GOWEN: The chambers are very small; they are usually separate.

The CHAIRMAN: Is the action at the end of the shell? Is it by attrition, or is it by the action of hydrochloric acid?

Colonel GOWEN: That I hardly know. It is assumed that a portion of its body, adhering to the wood as a fulcrum, constantly turns round the shelly portion, forming its head, and so bores through the wood It is necessary, in order to secure the *teredo*, to split the wood directly it comes out of the water, otherwise the body of the animal turns into water, it is such a mucilaginous substance. At Sevastopol they are extraordinarily large.

The CHAIRMAN: Do I understand that the depth of the Russian vessels in the mud was 19 feet?

Colonel GOWEN: From 19 to 23 feet.

The CHAIRMAN: They were actually submerged in the mud that depth?

Colonel GOWEN: Yes; the vessels were submerged that depth in the mud. Wherever the vessels are submerged in the mud, and wherever the sediment had settled upon any portion of a vessel, the *teredo* never entered it, and even while the paint remained, they never entered it, otherwise they perforate very quickly indeed.

Admiral Sir EDWARD BELCHER: Will you allow me to ask by what process you manage to disengage vessels when sunk to that depth in the mud, because they would create, as it were, a vacuum beneath them, and it would require a great deal of tickling and ingenuity to make them quit their beds? If you could manage to get air beneath them you would be able to make them move. I would also ask whether you have any mode of ascertaining the weight of these vessels when removed from the mud and suspended in water, so as to calculate upon the powers that you would require to lift them even a foot?

Colonel GOWEN: In the first place, nine-tenths of the vessels in the harbour of Sevastopol were in 20 feet of mud, gravel, oyster-shells, and very hard clay about the consistency of the London clay. But invariably these vessels had gone down and their keels rested upon the solid stone. The bottom of the harbour is of limestone formation, and the swell of the sea beating upon the vessels produced a slight swaying motion, so that there was usually a little space on one side or other of each vessel, and for that reason they weighed a little more when under the mud than after we had extracted them.

Sir Edward Belcher: I mean when you had raised them out of the mud altogether, had you any mode of determining what their weight was? I suppose they were filled with mud?

Colonel Gowen: All filled with mud. We had a mode of detecting that by the displacement of water. I had marks inside the caissons which denoted the number of tons by the quantity of water which had been expelled from them. The "Vladimir" weighed about 5,000 tons. She was the heaviest vessel, and was entirely filled with mud.

Sir Edward Belcher: Then, in point of fact, as to the lifting power, you fill the caissons and let them sink to a certain depth, and then pump out the water?

Colonel Gowen: Yes, pump the water out. You will observe there is a compartment running longitudinally across the vessel. This compartment is constantly filled with water, and when you commence lifting, it acts as a counterpoise to the weight which comes from the opposite end. Then there are sluice valves between these compartments, so that you may regulate the quantity of water. It is like the old fashioned system of raising an anchor by the use of a long barge; they heave the head of the barge down, and then jump on the stern.

Sir Frederick Nicolson: Before the meeting closes I should like to express my regret that Colonel Gowen's paper was not placed on our card in the usual manner, because I think we should have had a much larger audience. It is a subject of very great interest, and I am sure it has been brought before us in the clearest possible manner. It was owing, I believe, to the absence of Colonel Gowen that the Council of the Institution were unable to place his name on the card. To ask one question, I did not quite catch whether the diagrams of the caissons were drawn to scale?

Colonel Gowen: They are drawn to scale.

Sir Frederick Nicolson: Because when they are published in our Journal they will be very valuable if they are drawn to scale. As I understood, you had only two caissons?

Colonel Gowen: Six.*

Sir Frederick Nicolson: Six to each vessel?

Colonel Gowen: Yes.

Sir Frederick Nicolson: Did you find any difficulty in getting the same strain on the chains from the different caissons? Because, in raising a vessel by "lumps" the great difficulty is to get the same strain upon all the lumps that are used. You have alluded to the "Foyle" that was sunk in the River Thames. The "Foyle" is an instance of the want of such appliances as Colonel Gowen's for raising vessels in the Thames. She was first taken in hand by a private individual. He had two small frigates placed at his disposal by the Government; he had as many chains as he could get from Woolwich and Chatham; yet, in the end, he found it impossible to raise this vessel—a vessel certainly not so heavy as many of the vessels that Colonel Gowen has raised. When it was afterwards taken in hand by the Conservators of the Thames, they found she was completely filled with mud; and owing chiefly to the difficulty of giving an equal strain upon the only lighters that they could apply to her, they found it quite impossible to raise her; and it ended in her being blown up. But the meeting will perhaps be glad to learn that she is now so entirely removed, that there is no obstruction to the navigation. I am sure we must all feel grateful to Colonel Gowen for having placed this matter before us. We sailors know how extremely difficult it is to do work under water; and when you come to these great depths of 60 feet, or 10 fathoms, in addition to the great depth of mud, we can conceive how difficult it is to raise even a small vessel; much more such large vessels as were sunk in Sevastopol. May I ask what was the size of the chains that you used?

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* In Plate xvii only four caissons are shown.

Colonel Gowen: About three-inch, of Low Moor iron. You were referring to the vessels and to the unequal strain coming upon them. You observe the chains pass over these wheels, and that if the strain is unequal, the caissons cant on either side, and adjust themselves to the weight.

Sir Frederick Nicolson: You are speaking of one caisson?

Colonel Gowen: No, of all six.

Sir Frederick Nicolson: How do you get the same strain on all?

Colonel Gowen: In the first instance, they are sunk to the level of the water. Here are five shieve blocks, with a fall to this winch, and the chains are drawn as taut as possible. Then, the pumps are set at work, and if there is more strain on this chain than on that, the caisson comes up sideways, and gives to the other chain an equal strain.

Captain Horton, R.N.: Would you be kind enough to describe the diving apparatus that you used?

Colonel Gowen: I used several systems of diving apparatus. I used a diving apparatus that was constructed by Messrs. Siebe, and also one by Messrs. Heinke. I found that which was constructed by Messrs. Seibe's far superior to the other.

Captain Horton: Both of them with helmets?

Colonel Gowen: Both of them with helmets. I had about 150 naked divers! they were at work getting the anchors and chains from the boom across the harbour, which was a very difficult process, because this boom was made of ships' masts, which were clamped together with chains. Then there was a timber put over them, strapped over again with chains, and then the whole was solidly bolted together. The whole boom was nearly a mile long. We had to blast it. Then the chains to which the anchors were attached were also strapped round. The Russians took the greatest precautions in that respect for fear the allies might go in and disengage the chains, so as to allow their vessels to enter the harbour.

Sir Edward Belcher: With regard to the boring of the *teredo;* as a naturalist, I may tell you that I possess all the different shells of the perfect animals that make these holes. They are not all of the *teredo* species. A great number of them are *pholas* and they work behind a shield. In my own vessel, on the coast of Africa, in six weeks, they bored through a plank of two inches. I have most splendid specimens, much finer than any the British Museum possesses. But in the cases of the *teredo;* the *teredo* works, and carries its shelly case with it, all the way through. I have a *teredo* shell about that length (23 inches long, by 1¾ diameter), with a thickness of one-sixteenth of an inch on its whole length; so it is a solid creature, in fact. The *pholas*, in the case of very large shells, will bore through what no knife or tool, unless it is of very superior steel, will touch. There is one of the tribe that commences as a living gelatinous animal, and ends positively as a solid piece of calcareous matter which no iron tool will touch. If any person would like to see the specimens which I have, I would gladly lend them to the Museum of this Institution.

Sir Frederick Nicolson: I might just say a few words more. Colonel Gowen has alluded to the "Missouri." I happened to be at Gibraltar shortly after that vessel sunk. I was very much struck with the extraordinary diving capabilities of the Greek divers employed on that vessel. They did some anchor work for me. They used to sling anchors in a most wonderful manner, in ten or twelve fathoms. I was assured that the head man had brought up a sponge from thirty fathoms. I think this fact is worth mentioning, as a proof of the extraordinary capacity these men have for diving.

Captain Fremantle, R.N.: Perhaps Colonel Gowen will give us a little more information about the size of those caissons?

Colonel Gowen: Their capacity was about 5,000 tons. They were 100 feet long, 65 feet in width, and 22 feet in depth. An open trussed girder frame, you observe there. There were six, running fore and aft, in order to give rigidity to the structure. Iron is far superior to wood; but I could not get iron there, and I was obliged to go up into Poland. I was two years in getting timber floated down the Dneiper, and then I was obliged to have it sawn into planks. I think I consumed 1,600,000 feet of timber. That was all done by hand-work. The timber framing being 16 inches square, was, of course, hewn out. But the outside planking was invariably 6 inches thick. That was all sawn by hand, which was a very slow process.

The Chairman: Did the large establishment at Nicolaief give you no assistance?

Colonel Gowen: That large establishment was not in existence then. Just before the war, the Russian Government had purchased the largest saw-mills in the world, and the vessel was ready to sail down with the machinery, and was at Gravesend when the war broke out. Your Government seized those saw-mills, and they were put up at Woolwich. Since then a saw-mill has been erected at Nicolaief. I think they were nine years in constructing the building.

Dr. Edis: May I ask how you worked the chains?

Colonel Gowen: In the first instance, I proposed that the chains should go through the centre. As soon as the chains drew taut, they came against the side of the vessel, and it brought the two caissons necessarily together; it was impossible to separate them. Then, I had large cast iron wheels upon pedestals at one end of the vessel, over which the chain passed; and to counterpoise the weight that was suspended there, I had water introduced into the after-compartment. This indicated the lifting power.

The Chairman: I am sure that the meeting will join me in thanking Colonel Gowen for the very clear and instructive lecture that we have had. So much information could not have been given in a clearer manner than we have had the pleasure of hearing this evening. I can only hope that others external to us, may be influenced in favour of his system of raising vessels, and that he may succeed in his endeavours to get a company up. I should like to explain to Colonel Gowen that, although there is a small audience here to-night, owing to the little notice that was given under the circumstances, yet, as all that is said here appears in our Journal, he will understand that his paper will be widely read, because the absent members are fully alive to the value of the proceedings which take place in the theatre of this Institution. We are much obliged to you, Colonel Gowen.

LECTURE.

Friday, May 21st, 1869.

Rear-Admiral SIR JOHN C. D. HAY, Bart., M.P., F.R.S., in the Chair.

THE MARTINI-HENRY RIFLE (THE NEW MILITARY BREECH-LOADER).

By Captain Vivian Dering Majendie, R.A., Assistant Superintendent Royal Laboratory, Woolwich.

The subject on which the Council of this Institution has honoured me with an invitation to lecture this afternoon, is the Martini-Henry rifle, the proposed future arm of the British soldier. It will be necessary, however, in order to make what I have to say respecting the contemplated introduction of this arm intelligible, to take you back a little way in the history of the subject, and to recall something of what I stated in this lecture-room two years ago. We can only reach the arm of the future, in fact, by glancing at the past, and by making good our position with regard to the present. Of the past, however, not much need now be said. Still, there is something more about it than a mere archæological interest; and one might well refer to the curious fifteenth and sixteenth century prototypes of our nineteenth century breech-loaders, with a practical purpose—with the purpose, namely, of realizing the fact that, in those early days, the earliest days of firearms, there was an instinctive striving after a development which has only touched its accomplishment now, four centuries later. If, carrying our reflections on this point a little further, we endeavour to explain the long-delayed fruition of these hopes and efforts, we shall find such explanation partly in the imperfect state of mechanical and scientific knowledge, and partly in the absence of a thorough perception of the necessities of the case, due to the simple fact that the necessities had not yet arisen. Then eventually had come the clearing away of the obscurity which beset the subject, the gradual solution of its difficulties, the sort of revelation which told us that the objections to cartridges containing within themselves the means of ignition, had in reality no force, the enlightened appreciation of the military advantages of breech-loaders to which this revelation gave rise, and which otherwise followed as a natural consequence the development which small arms had received in every other direction: finally, the stimulus which the question derived from the actual performances of a certain very famous, but really indifferent breech-loader in actual warfare, and its immediate quickening into vigorous life. What is most noticeable about the past, and what I chiefly wish to insist upon is, that at no time was the subject altogether devoid of a certain vitality. In the early days of fire-arms, breech-loading was rather the rule than the exception. Thus, a French writer on the arms exhibited in Paris in 1867 divides the present breech-loaders into six classes, five of which classes, he says, are represented among the guns of the sixteenth and seventeenth centuries; while the comparison between the earlier models and the later reproductions is not always, as far as simplicity is concerned, on the side of the more modern gun. My own impressions, derived from a careful examination of the arms at Paris, accord, I am free to admit, very fairly with those of M. de Brughat. Then, considerations and difficulties of all sorts crushed breech-loading out of seeming life, and for a long lapse of years it so remained. But it was sleep, not death. And when the proper time came—the proper time, mark, as we shall see presently,—the epoch which arrived in the process of the natural development of firearms—the trumpet of war sounded twice, quite distinctly, once in Denmark and again in Bohemia, ringing out in each case no faltering note, but speaking to the irresistible success of a weapon too long neglected, and, like the Prince's horn in the pretty fairy tale, awakening the nations, and resolving their dreamy contemplations into daylight realities.

There, then, running through the dark years of distant ages is the silver thread of the subject, which however often hidden by the woof, patience still may follow—the thread which binds us, I believe, directly, however lightly, with a period some four centuries distant.

The explanation of this connection I have already indicated when I spoke of the instinctive yearning for the employment of a breech-loading system. For, in truth, it amounts to an instinct, and no man would naturally elect to introduce his charge at the muzzle, unless the pressure of difficulties, or habit, or prejudice, drove him to do so, and unless he saw no sufficient reasons to induce him to resist and overcome that pressure. The explanation of the temporary abandonment of breech-loaders I have also indicated in what I have said of the actual presence of these difficulties, and in the actual absence of an adequate appreciation of the merits of the system and of the necessity for its introduction. It is, perhaps, worth while to notice that the revival took place most vigorously in the country which had most developed her mechanical gun-making industry, viz., in America, because the fact bears upon the close relations which exist between breech-loading and the mechanical art. It seems, also, worth while to notice that, despite her mechanical advantages—or, perhaps, I should say in consequence of those advantages—America did not strive in the direction in which so many inventors of breech-loaders have unfortunately laboured, only to meet with disappointments, and to find themselves in the end obliged to retrace their steps. Speaking generally, it may be said that America made no attempt to throw the work of closing the breech upon the mechanical fit of that part of the gun, notwithstanding the skill and ingenuity which she might have brought to bear upon the problem. Americans were, indeed, too sound mechanics to attempt that which was mechanically unsound. Thus, we find the self-consuming cartridge generally rejected by the Americans, and the non-consuming metal cartridge, *cartouche obturatrice*, as the French appropriately call it, generally employed.

Thus we reach the point of the practical revival of breech-loaders, which took place about three or four years ago.

You will, perhaps, recollect that after the Dano-German war, General Russell's Committee, which Lord de Grey had appointed to report upon the advisability of arming the infantry, either in whole or in part, with breech-loaders, did report in July, 1864, that it would be desirable so to arm the British soldier; this however, without reference to any particular system. Then, how was this recommendation to be applied? A decision, the wisdom of which is, I think, indisputable, was come to. It was decided to endeavour, in the first place, to utilize the existing store of muzzle-loading arms by converting them into breech-loaders, proceeding, meanwhile, to the larger question of the selection of a totally new arm for future manufacture. This decision not only recommended itself because of the saving of time in the re-armament of the British soldier, which it tended to effect, while it also afforded time for the leisurely consideration of the more difficult question of the adoption of a new arm, not only because of the economy of using up the existing arms, and of the advantage to be derived from the acquisition in the course of the conversion inquiry of a vast amount of experience, likely to be invaluable in the future and fuller inquiry: not only, I say, did the decision recommend itself on these grounds, but it was based upon a very sound and by no means common perception of the real elements of the problem. It proceeded upon the sound principle of separating the shooting part of the gun from the loading part. We had a gun, which, as far as shooting went, was very accurate, which some will even now contend is quite accurate enough for the rough and ready shooting of actual war. What we desired was to multiply its rate of delivery to a point consistent with the requirements of the age. We shall see presently that the same principle of separation has governed the course of action of the Breech-loading Committee, and most properly so. The question of accuracy is so far independent of the question of facility of loading—the character of the fire is so distinct a thing from its rapidity, as to demand separate investigation. And the two questions have therefore received separate investigation throughout the whole of the inquiry; first, in the decision to convert the Enfield by fitting it with a breech-loading arrangement; second, in the decision, which I shall have presently more particularly to notice, to carry out the barrel and breach-loading tests independently; the embodied results of this course of action we see, first, in the Snider-Enfield; second, in the Martini-Henry.

Well, gentlemen, I need not trouble you, I think, with the history of the Snider-Enfield.

I ventured two years ago in this room to predict a successful career or this arm, a prediction to which I am justified, I think, in looking ack with satisfaction. The arm has now been tried and acquitted itself well under the most extreme climatic influences, and it has won its purs on actual service in Abyssinia. The Breech-loading Committee ay that the Snider-Enfield is, "without doubt, a most efficient military weapon." Indeed, so little likely is this opinion to be disputed on the present occasion, that it seems to be unnecessary for me o press upon you, as I might do, the weight of two years' accumulated experience in favour of the arm. You may, perhaps, be inerested in seeing a rifle which has fired, more rounds, probably, than any other rifle in the world. Here is a Snider-Enfield which has fired, under my superintendence, 72,000 rounds, actually without requiring any repair, and which is still perfectly serviceable. Here, too, is a target of 12 inches, which was made with this rifle only four days ago. So also of the cartridge, upon which the success of the system, in a great measure, hinges. That is now generally admitted to be an exceedingly satisfactory cartridge. With the exception of one pattern (No. V), in which, with a view to economy, the amount of material, and, consequently, the strength had been, as the event proved, unduly reduced, these cartridges have admirably fulfilled the requirements of the service; and not only this, but the construction has been finally adopted by the Committee as that best suited for a military cartridge. In short, while the arm itself is to be replaced by a weapon of superior efficiency, the cartridge (I do not refer to the bullet) remains substantially unchanged, retaining its position as the service cartridge *per excellence.* I should, perhaps, mention, that for exceptionally damp climates of fluctuating temperature, such as India, it has lately been shown to be necessary to adopt some extra internal protection, and this thin paper lining, with a thick intermediate coating of varnish, has been recommended for this purpose, to prevent the action of the powder upon the brass: also the bullet is to be varnished to prevent corrosion. To avoid the inconvenience of having two ammunitions for the same arm, it is proposed to apply this protection to all cartridges for future manufacture, for whatever climate.

I think, therefore, that we may fairly say that the intentions of those who decided upon the conversion of the Enfield rifle, and the hopes of those who recommended the adoption of the Snider system of conversion and the Boxer cartridge, have been most satisfactorily fulfilled. Every one of the contemplated advantages has been satisfied. The re-armament has proceeded so rapidly, that over half a million rifles have been converted, and our regular troops of all arms, the Navy, Marines, and a proportion of the Militia have been furnished with breech-loading rifles, in addition to the establishment of a sufficient store to meet emergencies. We have also been afforded two years' breathing time in which to work out the question of the selection of the new arm. The conversion has satisfied the condition of economy in a high degree, having at the comparatively small cost of under 20*s.* an arm, given us a weapon of great efficiency, and one of a character which, when the new arm is introduced, may be confidently passed on to the reserve forces. Finally, it has afforded us an opportunity of accumulating a vast amount of experience—how much and how valuable, those only who have closely watched the development of the question are really able to say. Our ideas on the subject of breech-loaders have during the inquiry clarified and broken up; inchoate opinions have assumed a coherent form; false principles have been rejected, sound ones have been affirmed. Briefly, we have mastered, I hope, the grammar of the subject. Think, for example, what it is to have definitively disposed of so-called self-consuming cartridges; to have made a deliberate selection of central-fire in preference to either of the other modes of ignition; to have decisively driven pasteboard cartridges out of the field. Think again what it is to have affirmed, as the Breech-loader Committee have done in very precise terms, and in a very practical way, that breech-loaders which depend upon the cartridge to close the breech should not at the same time depend upon the cartridge for their ultimate safety—should not, that is, be liable to be blown open in the event of any failure in the obturation. I say this was practically affirmed by the Committee in their decided and summary rejection of all arms which, like the Snider, have a breech which is not secure in the event of an explosion. And this opinion has been practically adopted by the Government in the latest pattern of Snider rifle (III.), of which I have a specimen now in my hand, and which is one of a few thousands which it has been found necessary to manufacture, to prevent the store from being exhausted. In this arm, which is not a conversion, but a new rifle with a steel barrel, the breech block is fitted with a locking bolt of a simple character, to prevent it from being blown open. Some casualties of this sort have occurred—no very heavy percentage, but sufficient to illustrate the disadvantage of a non-safety breech. Just as I object to depending wholly upon your gun for your gas check, so do I object to depending wholly upon your cartridge for your safety. The one principle is an extravagant reaction on the other, and equally false. It is both economically and mechanically false to depend for safety wholly on your cartridge. Economically, because if you have a safety breech, you may confidently employ a weaker, and therefore a cheaper, cartridge—such, for example, as that pattern (No. V) of which I have spoken as having had to be abandoned because of this risk of occasional casualties involved in its use. Mechanically false, because the success of your system is then contingent upon a niceness of combination, a perfect accuracy of manufacture and material in arm and ammunition, which it is, I should say, impossible invariably to secure, or which can only be ensured at an outlay which we are not justified in incurring if we can possibly avoid it. And in this instance we can avoid it, avoid the necessity for such extreme accuracy of manufacture, avoid even the remotest risk of accident, by the simple adoption of the principle which has now been applied to the Snider, which has greatly improved the arm, which has remedied its only observed defect, and which, no doubt, will henceforth be generally accepted.

So much for one branch of the breech-loading question—the temporary provision for present use of an efficient arm, and of the light which has meanwhile been thrown upon the whole subject. The other branch is the selection of a new arm for future manufacture. You will perhaps, say, If the Snider is what you have stated it to be, if it is really "a most efficient military weapon," why supersede it? To this I answer, There was no foregone determination to supersede it at all. If the Snider could hold its own against the numerous improvements of an active age, well and good; the Snider would in that case properly remain the service arm of the British soldier. But was it reasonable to expect that the ingenuity, which for some years has been concentrated upon the production of a good breechloader, could suggest no improvement in an arm of which the breech-action (which, moreover, was hampered with the condition of its application to existing arms), was adopted in 1866, before the period of unexampled activity in this direction; and of which the shooting apparatus had been adopted in 1853—16 years ago? With regard to the last point, I cannot do better than read a passage from a report of the Ordnance Select Committee on systems of rifling, dated 26th November, 1862:—"The Enfield rifle was introduced into the service at "a period when comparatively limited experience had been acquired "in this country with respect to elongated rifle bullets, and when no "fixed and generally accepted principles had been established as to "rifling small arms. The gun trade were themselves much divided "in the opinions they held, and those that were accepted as the best "were founded rather on speculation or arbitrary rules, than on experience or scientific reasoning. Under such circumstances, the "highest credit is due to those who, selecting and combining such "proved advantages as then existed, produced a weapon, which not only "at that time was, but is still (1862) believed to be superior to any arm "adopted by other countries. Since the year 1853, however, not only "has the attention of scientific men been directed to the improvement "of rifled fire-arms, but the value of their theories has been tested both "at home and abroad, by an amount of careful experiment which "exceeds that of any other period. The result of these labours has "been the production of rifles of greatly increased precision at long "ranges, a point of considerable importance when the improvements "in modern artillery are taken into consideration." Thus the inquiry was instituted not, be it understood, in order to supersede the Snider-Enfield, but in order to discover if, as was reasonable to expect, such supersession was necessary. For this purpose, the Snider rifle and its ammunition were taken as standards, to which any system putting forward claims to acceptance must be not merely equal at all points, but which they must excel. In order to bring together all that there was of new and good, ingenious and serviceable in military fire-arms, the War Office authorities on the 22nd October, 1866, cast a net weighted with heavy golden prizes and opportunities of distinction, in the shape of an advertisement addressed "to gunmakers and others." The meshes of this net were so contrived, that anything smaller than the Snider, any arms of inferior merit, would soon slip through, while any of equal or superior importance would be retained to be afterwards fully tested, until finally a few choice specimens should remain, from which the final selection might be made. To award the prizes, a special committee was appointed, consisting of Lieut.-Colonel Fletcher (Scots Fusilier Guards), Lord Spencer, Captain Mackinnon (3rd Regiment), Captain Rawlins (48th), and Mr. Edward Ross.

In the first instance 104 rifles were submitted, of which no less than 67 failed to comply with the terms of the advertisement, and were, therefore, as far as the prize competition went, out of the race. Eventually, by a process of elimination which need not here be described, the 37 arms which were eligible to compete, were reduced to 9, which were recommended for further trial, each of the inventors being paid £300, and required to furnish for experiment at Woolwich 6 arms, in strict conformity with the specimen arm submitted, with 1,000 rounds of ammunition per arm, within four months after date of demand. It is unnecessary to dwell upon the various incidents, often ludicrous, which relieved the tedium of this first stage of the inquiry, incidents which oscillated between the excess of caution exhibited by the inventor, who point blank refused to run the risk of firing his own gun, and the excess, in the other direction, of misplaced confidence, which nearly proved fatal to the designer of a safety bolt, which exhibited its efficiency, by allowing the breech to be blown violently open in the inventor's face.

The nine arms selected to compete for the prizes, were the Albini and Braendlin, the Burton (No. 1), Burton (No. 2), the Fosberry, the Henry, the Joslyn, the Martini, the Peabody, and the Remington.

It is not, I think, necessary to follow the prize competition very closely. It has little practical interest now. The object, as far as the public was concerned, was fulfilled directly the arms which this competition was instituted to attract, had been brought together. It was of course just possible, that among the competing arms there might be one so satisfactory at all points as to warrant its adoption into the service; but as this proved not to be the case, it would only be wasting time to dwell upon this stage. Suffice it to say that the broad results were as follows:—The competition commenced on the 29th October, 1867, and the conclusion was reported on the 12th February, 1868. The whole of the nine rifles fell short of the qualifying figure of accuracy, and in most instances the standard was not reached in other respects. Therefore the first prize of £1,000 was withheld altogether.

The second prize of £600 for the best breech-mechanism was awarded to the Henry rifle, which arm, it is fair to observe, most nearly attained all the required qualifications. Indeed, this rifle was disqualified for the £1,000 prize, chiefly on account of non-compliance with the condition of employing only pure beeswax for the lubrication. The fortunes of one other arm in this competition must be noticed. The Martini not only failed to receive a prize, but was placed seventh on the list. Naturally the question will occur to you, How was this? How is it, that while the Henry breech-mechanism obtained the prize in this first trial, the Martini breech-mechanism is now finally preferred? Is there no contradiction here? None whatever.

The explanation is simple enough. The Martini, I quote the words of the Committee, "failed entirely, owing to the defects in ammunition." Mr. Martini had submitted copper rim-fire cartridges with his gun, which burst repeatedly near the rim, and exhibited the arm in so unfavourable a light, that it was impossible through the thick cloud thus established, to recognise its merits. The lesson to be derived from this is an instructive one. In a few words, it amounts to this: "A breech-loading arm stands or falls in a great measure by its ammunition." Give the best gun in the world a bad cartridge, and the gun must prove more or less of a failure—more or less inferior to arms of inferior intrinsic merit. The cartridge is in fact a part, and a very important part, of the breech. A decided failure in this part practically determines the failure of the whole, as conversely the success of the cartridge determines in a large degree the success of the gun. When, as in the case of the Snider, the breech is a non-safety breech, the failure of the cartridge will entail explosive escapes, dangerous consequences, in fact, the total failure of the system. When the arm has a safety-breech, like the Martini, the consequences of a decided failure of the ammunition fall short of this. They are not dangerous, but merely disastrous to the system. But this fact is rarely recognized, and the cartridge is scarcely ever credited with its proper share of the success. In the accounts of the Wimbledon competitive shooting, for example, even in the Report of the National Rifle Association, the cartridge used with the successful breech-loaders is not so much as named. Thus, the gun-competition was concluded against the whole of the arms, as perfect systems; but in favour of the Henry, considered merely as a breech-loader.

Then there was the cartridge-competition, for which a very few words will suffice. The Government Boxer ammunition was not allowed to compete for the prize; and the same construction of cartridge adapted for a small bore calibre had not been formally submitted, although it was successfully employed with many of the competing arms. Of the 49 sorts of cartridges formally submitted, 48 were considered unlikely to fulfil the conditions of the War Office advertisement, which had prescribed, that they should be "as little liable to injury by rough usage, damp, and exposure in all climates as the Boxer cartridge; also as little liable to accidental explosion as the same cartridge, and as capable of being manufactured in large quantities, and of uniform quality." This left but one cartridge in the competition, that which had been submitted by Mr. Daw, and which resembles the service cartridge in having a case of thin coiled brass, but which, unlike the service cartridge, is secured by soldering the edges, instead of cementing them together with paper, and is fitted into a base of the construction generally known as the "Pôtet," and which consists of sheet brass stamped into the form of a flanged cap. To this cartridge, which appeared to the Committee to fulfil the prescribed conditions, the £400 cartridge prize was awarded. But in the course of the trials, it was proved that the Government cartridge-case, which, for the reasons I have stated, was not deemed eligible to compete for the prize, was the best; and the Committee accordingly decided to use it exclusively in the subsequent experiments. Thus the results of both gun and cartridge competition were destined to prove abortive. A gun which satisfied the required standard of excellence was not forthcoming; the breech mechanism which received the prize has since been adjudged not to be the best; and the prize cartridge is pronounced inferior to one not in the competition.

Still, this stage of the enquiry was not thrown away, if we look only to the object which it had satisfied of collecting a number of arms, to the experience which was acquired during its progress, and to the clearance of the subject, which was thereby effected. Directly we leave the prize competition it is like emerging from a tangled thicket, in which trees of all sorts are growing crosswise, in which all is confused and obscure; and one can imagine the relief of the Committee when they found themselves once again in the free field of experimental inquiry, unhampered by this restriction and that, no longer forced to shut their eyes to possible excellencies in a system because the inventor had neglected to conform in some minute particular of weight or length to a prescribed standard, no longer compelled to decide on the comparative merits of arms which had not one feature of calibre, weight of charge, nature of cartridge, &c., in common, by which they could be compared.

It was now possible for the first time to bestow due attention upon several promising systems which had been, in the first instance, disqualified. It was now possible, also, to pit one mode of rifling directly against another, to measure with some confidence the advantages of various breech mechanisms, to discover, in short, what each system taken at its best could do, and which was capable of reaching the highest point of accomplishment.

In order to do this properly, it was necessary to reduce the various systems to one common denomination; and, as a preliminary measure, it was resolved to separate the question of barrel or shooting from that of breech action or loading. On this decision I have already commented by anticipation, and need now only repeat my opinion, that it was a thoroughly sound and wise one—the only course, in fact, calculated to ensure the production for the use of the British soldier of the best procurable weapon.

By way of deciding upon the elements which should furnish the common denominator for the barrels, evidence was taken from gentlemen of the highest qualifications and experience in matters connected with small arms. Among those who gave evidence I find the names of His Royal Highness the Duke of Cambridge, Lieutenant-General Hay, Colonel Haliday (Inspector-General of Musketry), Colonel Dixon, Colonel Boxer, Colonel Halford, Professor Abel, Messrs. Whitworth, Lancaster, Westley Richards, Rigby, Burton, Kerr, Henry, &c.

The evidence was sufficiently concurrent, and the experience of the Committee had been already sufficiently clear, to enable a decision to be come to on the following points:—With regard to calibre it was resolved to adopt a ·45″ bore, in preference to the large service bore of ·577″, or the intermediate bore of ·5″, a point, on which the Committee were further fortified by the authority of no less than fou previous decisions. The weight of bullet was fixed at 480 grains; in construction it was required to be solid; a charge of 85 grains of powder was adopted. The length of the barrel was fixed at 35 inches; its weight at 4 lbs. 6 oz.: and by preference, although not absolutely, steel was adopted as the material. The lubrication was required to be pure beeswax, as that best adapted to withstand variations of climate, long keeping, &c.

Of course, the wisdom of each of these conditions is open to discussion; but it must be recollected that each of them had been very fully discussed by experts, and the Committee were guided in their selection by the preponderance of opinion, without requiring or expecting absolute unanimity. Where it was impossible to come to any decision without begging the question presented for solution, or arbitrarily cutting the knot created by conflicting testimony, as in the case of the nature of rifling, the method of stocking, the quality of powder, &c., no conditions were imposed, and each competitor was free to make his own selection.

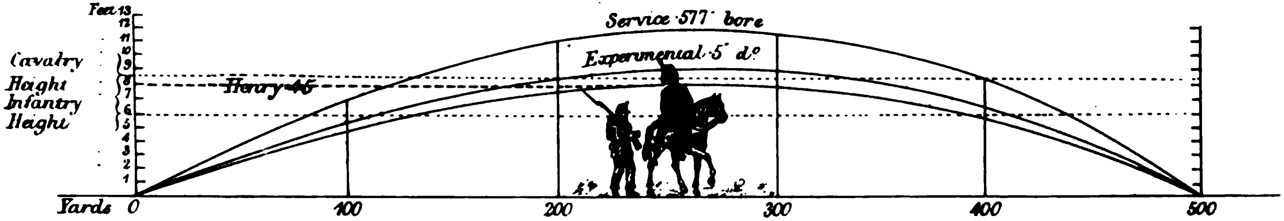
For the purpose of making the comparison between barrels fulfilling the above conditions, but differing where differences were necessarily permitted, it was desirable to adopt temporarily some one breech action, and to use for the whole the same cartridge case. The Snider-action was at first decided upon; but as its use would have entailed some delay, it was eventually decided to use the Henry breech-action (which, as we have seen, had already gained the £600 prize), and the Boxer cartridge. A circular letter was, on the 9th March, 1868, sent to the representatives of the most successful and best known systems of muzzle-loading rifles, embodying the above conditions and inviting their assistance. With one exception, the assistance thus asked for was promised, and the following gentlemen undertook to supply barrels for the purpose of the competition:—Mr. Whitworth, Mr. Westley Richards, Mr. Lancaster, Mr. Rigby, and Mr. Henry. Colonels Dixon and Boxer represented the Enfield system of rifling. I should be largely exceeding the limits of this lecture were I to attempt to describe in detail the distinctive features of the six barrels, the rates of twist, nature of rifling, &c.; and as I do not wish to go into figures on this occasion I shall not attempt to do so. To the six ·45″ bore guns, a ·5″ barrel (Enfield rifling) was added for the purposes of comparison. The competition became, ere long, reduced to four barrels, viz., the Enfield ·5″ bore, and the Henry, Whitworth, and Enfield ·45″ bores. But before the 1,000 yards range was reached, only three arms remained in the race, the Henry and the two Enfields. Of the two ·45″ inch bores, the Henry system proved considerably superior in accuracy to the Enfield; and as it had already shown that its trajectory was as flat as that of any of the other ·45″ bores which it had excelled in accuracy, while it did not exhibit any liability whatever to foul with continued firing, the Henry rifle became established as the best of the small bores, on the two important points of trajectory and accuracy.

Here, however, it is only fair to observe—and I wish to do so with all possible emphasis—that the inferiority of the other systems in this particular competition proves nothing as to their relative abstract merits or capabilities. Several of the competitors represented that the time allowed was too short to enable them satisfactorily to work out the problem of obtaining good shooting from a barrel hitherto only used for muzzle-loading arms, and now to be used as a breech-loading barrel. Indeed, one inventor expressed an opinion, which has certainly been contradicted by the result, that no good shooting could possibly be obtained under the conditions laid down. Therefore, it may reasonably be urged that this result constitutes no substantial triumph of one system over another. But this it does appear to establish, that of the various systems, the Henry is, at the present time—or was, a few months ago, when these experiments took place—the one which best fulfilled the conditions which, by a preponderance of competent opinion, are held to be requisite, or best adapted, for a military rifle. And the decision not admitting of indefinite postponement, but being a present necessity, no course was open but to accept the Henry combination as the best of the ·45″ bore systems, without reference to the possible developments which the inventors of other systems might be sanguine of effecting hereafter at their leisure. It will be time enough to return to the other systems when they can press fresh claims for consideration. But besides beating the rival ·45″ bores, the Henry was required to establish also its superiority to the ·5″ bore, and to the service ·577″ bore which had been taken as a standard, before it could be recommended for adoption. I find it very difficult to convey an idea of the results of this part of the competition without going into figures, which would be dry and difficult to follow. Expressing the figures briefly in words, I may say that in trajectory, in accuracy, in initial velocity, and in penetration, the Henry proved superior to the two arms placed in comparison with it. As regards trajectory, the annexed diagram (Plate xix) and table show the advantage of the small bore, and illustrate for purpose of comparison, that a cavalry soldier would be nowhere safe against a Henry rifle fired at a 500 yards' range, while with the ·5″ bore there would be safety for 104 yards in the centre of the range, and with the service bore for 262 yards, or more than half the distance, during which the bullets would be flying over his head. As regards accuracy, the superiority of the Henry to both rifles, especially at the longer ranges, is very marked. The initial velocity of the Henry (with Curtis and Harvey's "No. 6" powder) is 20 feet a second higher than that of the ·5″, and 110 feet higher than that of the Snider.

Trajectories of Henry, ·45″, Experimental Enfield, ·5″, and Snider-Enfield, ·577″ Rifles.

	Safe Distance for Cavalry.	Safe Distance for Infantry.	Greatest Height of Trajectory.	Initial Velocity.
	Between	Between	Feet.	Feet.
Snider, ·577″.....	138 and 400 yards	92 and 438 yards	11·9	1362·7
Experimental Enfield, ·5″	221 and 325 „	123 and 406 „	8·9	1342·7
Henry, ·45″......	Nil	139 and 396 „	8·1	1252·8

TRAJECTORIES
of
SERVICE ·577", EXPERIMENTAL ·5" & HENRY ·45" BARRELS



The penetration trials were very interesting, giving a penetration to the Henry of 14½ elm planks, ½" thick, as against 8½ with the other arms; and a penetration through iron plates of over ½-inch thick at 200 yards, while the service arms failed at 100 yards. Gabions and sap rollers were pierced by the Henry; rope mantlets by the Henry up to 350 yards, while the Snider failed at 50 yards. (For particulars of penetration trials, see Appendix A.) Finally, when fired into the carcass of a horse, the Henry rifle was certified by a veterinary surgeon to have produced the most formidable wounds, smashing bones against which the other bullets flattened, or from which they glanced off. Of course, these results are to be, in a large degree, credited to the hardened bullet used by Mr. Henry. The amount of allowance required for wind is much less with the Henry than with the other two rifles, only about half as much at 1,000 yards in a fresh wind. On one point the larger bores had an advantage, viz., in a reduced length of cartridge; but as the weights and cubical measurements of the three ammunitions were as nearly as possible equal, and as the rapidity of fire with the longer cartridge—one of the points on which the difference may be expected to be felt—is considerably greater than that of the service arm and ammunition, and its power of resisting rough usage is not appreciably less, this element of inferiority, if such it is to be called, may be safely ignored, as of no real practical value.

The following table gives the lengths and cubic measurements of the three ammunitions:—

Lengths and Cubic Measurements of Boxer Ammunition for ·45", ·5", and ·577" bores.

		One packet of 10 rounds, packed as for service.
	Length.	Measurement.
·45" cartridge	3·75 inches	11·481 cubic inches.
·5" "	3·29 "	11·725 "
·577" "	2·45 "	11·583 "

Thus it came about that the Henry rifling was, in the end, accepted as the one "most suitable in all respects for the requirements of the service." It is now time, however, to state what the Henry rifling is. This diagram shows it (see Plate xx). It is a polygonal system, of nine or seven sides, the latter having been adopted in the new arm as slightly less costly to manufacture and equal in other respects; the angles are broken by ribs, which create re-entering angles, the inscribing circle tangential to the ribs being described with the same radius as the inscribing circle tangential to the plane sides. The twist is 1 in 22, uniform. The durability of this rifling is sufficiently established by the fact, that the barrel which I hold in my hand has fired as many as 30,000 rounds without any signs whatever of deterioration. Finally the expense of manufacture of barrels on this system is not greater than that of other ·45″ arms.

Before quite leaving the barrel question, I should make a few remarks on the general question of accuracy for military arms. I have always held a strong opinion that it is unwise to sacrifice to exceeding accuracy of shooting, other qualifications. If you cannot obtain such accuracy without serious loss, without incurring a danger of fouling, without unduly lengthening or strengthening your cartridge, without unduly increasing your strain, then assuredly the extreme accuracy should be thrown overboard. But it will hardly be contended that if without any such loss you can secure an exceedingly accurate rifle, you should not secure it. For ordinary purposes of warfare this great niceness of shooting is, I admit, not necessary. But if we go back to first principles, and look to the reasons which recommended the supersession of smooth bores, that, namely, we might strike an enemy with the greatest amount of certainty and at the greatest distance, then undoubtedly it will appear that accuracy is, *cæteris paribus*, a distinct advantage. A watch, as I have said before in this room, will serve ordinary men as well as a chronometer, but if for the same cost and without any loss of general efficiency, you can secure a chronometer, then unquestionably the chronometer is to be preferred. And this it seems is exactly what has been done in the case of the Henry. Not only does the adoption of this accurate system entail apparently no loss, but it secures to us some very important advantages, as flatness of trajectory, increased penetrative power, comparative freedom from the effect of wind. Therefore, if we take a bold, comprehensive view of the question in all its bearings, it will appear, I think, that the Committee exercised a sound discretion in selecting this rifle for the use of the British soldier. Only, the instruction of the British soldier in the use of an arm of precision must now be developed in proportion to the advantages which that arm is calculated to confer; and above all he must be taught that because he has a long range rifle it is not *necessary* for him to employ it invariably at long ranges—that, as a *general rule*, it is undesirable that he should do so. If, however, you can so improve him as a shooting machine as to enable him to do with the Henry at 800 or 1,000 yards, what he would have done with the Snider at 500 or 600 yards, then the adoption of the more accurate arm will be all gain.

Having thus secured a rifle of superior precision, we have now to inquire in what way that rifle should be loaded. That it must be loaded at the breech is admitted. But, in deciding upon a breech action, we must not fall into the too common error of regarding the question as one of mere rapidity. We have to look also to the durability of the breech mechanism, its simplicity, its safety, its ease of manipulation, its non-liability to injury by wear, exposure or rough usage; and while there are many systems which satisfy one and more of these conditions, there are comparatively few which satisfy all. Still, the number of promising breech mechanisms is sufficiently great to warrant, and the exigencies of the military service are sufficiently imperative to demand, the application of tests of great severity. Assuredly the tests applied by the Committee did not fail in this respect. Their general course was as follows:—The arms were carefully examined, and then 20 shots were fired for rapidity, sand was thrown over the actions both open and closed, and the rifle fired without any cleaning beyond what could be done with the hand. Cartridges purposely damaged to ensure an escape of gas were fired to test the safety of the arm with imperfect ammunition. Finally, each gun was put through a test of long continued firing, being allowed to rust by exposure at intervals between the days of firing, and having water poured into the breech to aggravate its sufferings.

The arms carried forward for this competition were 65 in number, viz., the nine arms which had competed for the prize, eleven arms which had been disqualified for the prize competition, but set aside as entitled to future consideration; and forty-five new arms which had been submitted after the first report had been rendered. I cannot attempt even to name the whole of these arms, still less to specify the grounds upon which one after another was rejected, until there finally remained only ten rifles, as follows:—The Bacon, Carter and Edwards, Kerr, Wilson, Berdan, Martini, Money-Walker, Henry, and two Westley Richards' rifles. Of most of these arms I have specimens here to-day. They fall naturally into two great classes—bolt-guns and block-guns. The first class is represented by the four first named arms; the second by the remaining six.

The bolt-guns were subjected to a special test to demonstrate their liability or non-liability to accidental explosion in the process of closing the breech. It has been urged that the closing of the breech might, in some instances, occasion the explosion of a sensitive cartridge—such a cartridge as may, in a small per-centage of cases, occur in manufacture. To test this, cartridges embodying these exceptional defects were supplied. Some had no safety shoulders on the anvil, some had long anvils, some had short caps, some had an increased quantity of detonating composition. All were more liable than a perfect service-cartridge to accidental ignition, but all represented cartridges which might possibly find their way into the service supplies. Without following the details of this stage of the competition too narrowly, or specifying the failures, sufficiently marked in two instances, I may say that only one gun, the Carter and Edwards, thoroughly satisfied the test. Still there remained with regard to this gun a supposed general liability, not shared, or, at least, certainly not shared in the same degree, by block-guns, to be exploded by the simple impact of the bolt upon the base of an over-sensitive cartridge, and the resulting concussion; and on this account the bolt-system was eventually rejected. It has been said that this objection is a purely fanciful one, and was contrived to meet the pre-conceived views of the Committee. I feel bound emphatically to dispute this statement. I know nothing, it is true, of the pre-conceived views of the Committee, if such existed; I know their views only through the medium of their Report. But this I do know, that the objection is not a fanciful one; and in proof of it, here is a list of 18 cartridges which have actually exploded in the mere process of handling, gauging, or unpacking, or by a simple fall upon the floor of the factory. (See Appendix B.) Therefore, I admit to sharing with the Committee the conviction that such cartridges, placed in the breech of a bolt-gun, might be liable to be occasionally exploded by the concussion of the bolt employed to drive them home.* The chance is remote, I grant, but that it exists, cannot, looking to the results of our experience, be effectually disputed.

We need, therefore, only follow the fortunes of the six block-guns. Here, I should mention that the breech-mechanisms had been reduced as nearly as possible to a common denominator by the adoption, for the purposes of the trial, of the Boxer cartridge-case, except in the case of the Westley Richards and Money-Walker rifles, which employed special cartridges.

In the rapidity trials, the block guns were ranked as follows:—

		20 rounds in
1st.	Westley Richards (elevating block)..	1 minute
2nd.	Martini........................	1 ,, 2 seconds
3rd.	Henry	1 ,, 7 ,,
4th.	Westley Richards (falling block)..	1 ,, 7 ,,
5th.	Berdan........................	1 ,, 10 ,,
6th.	Money-Walker	1 ,, 14 ,,

The sand and damaged cartridge tests were gone through by the whole satisfactorily.

The exposure-test, however, practically reduced the competition to the Henry and Martini-mechanisms, of which the latter gave the better performance, having been found in perfect order at the close of the experiment, while the Henry-mechanism had proved itself, in some slight degree, sensible to the severity of the test. Here it is worth while to notice the difference of the results obtained with the Martini when furnished with a suitable cartridge; the point on which I have before insisted is thus thrown into relief.

The competition being thus reduced to a match between the Martini and the Henry, a comparison was taken between the two on the essential points of safety, strength, number and simplicity of parts, facility of manipulation, and cost. With regard to safety and strength, both arms appeared to be equal. The number of parts of the latest pattern Martini is 27, as opposed to 49 in the Henry. The Martini, having no hammer, is easier to manipulate; and it was reported to be the cheaper to produce. Moreover, the absence of the hammer was regarded by the Committee as a distinct advantage, while the Henry discovered a possibility (remedied, I am informed, in a later pattern) of placing the cartridge in front of the extractor, and thus temporarily disabling the gun.

The Martini-gun you will perhaps examine more at your leisure after the lecture, and I have here a working section which permits of the action being readily inspected. These diagrams (Plate xx) explain its con-

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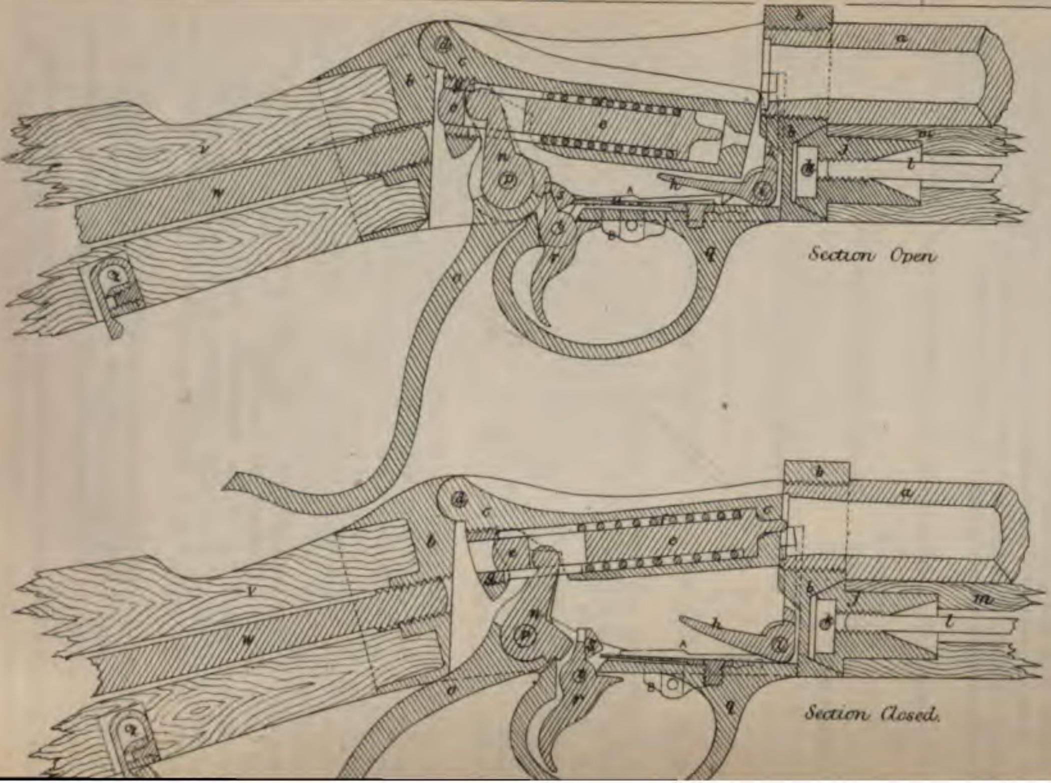
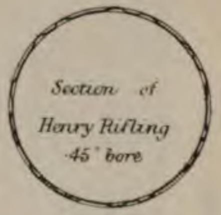
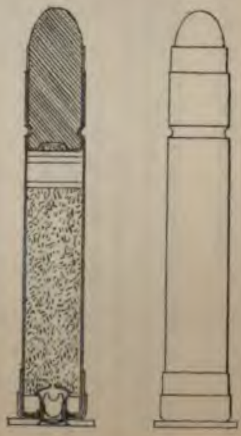
* The very strong evidence upon this point, given by Colonel Halford, and printed in the Report of the Committee is worth referring to.



Section Open

Section Closed.





J. Jobbins

struction, which consists, briefly, of a swinging block hinged upon a pin passing through its rear end; the recoil being taken by the shoe. The cartridge is exploded by a direct-acting piston, which is driven by the action of a strong spiral spring within the breech-block. The block is moved by means of a lever to the rear of the trigger-guard. The motion of pushing the lever forward, depresses the block, compresses the spring, and ejects the empty cartridge case. When the lever is drawn back, the block is raised and the breech closed, the arm remaining cocked—if I may apply that expression to a spiral spring. If desired, the safety-bolt can now be employed to secure the gun from going off. For my own part, I think that the proper safety-bolt for all guns is a strict determination invariably to regard them as loaded, cocked, and ready to go off, and invariably so to handle them that in the event of an accidental discharge, no serious consequences could result. Still, there is the safety-bolt, if you will have it. There is also an indicator at the side to show if the arm is cocked or not. This then is the breech-action, which, from all those submitted, was eventually selected by the Committee as the one best calculated to meet the requirements of the service. Still the question remained: Is this action superior to the Snider? On this point a careful comparison was made. The Martini is certainly and obviously quicker than the Snider, a superiority which would become still more evident if the Snider were fired with a long small-bore cartridge; it is of course safer than the Snider without a safety-bolt, while it is not less safe than the latest pattern. Both systems appeared to the Committee to be sufficiently strong, although here they saw an advantage in the divided stock of the Martini, as compared with the whole-stocking of the Snider, in which the wood is greatly cut away for the lock. In number and simplicity of parts, the Martini had a considerable advantage—27 against 39. The Martini is estimated to be cheaper to produce than the Snider. Therefore, it was decided to recommend the Martini-breech in preference to the Snider-breech for the new arm.

All that now remained was to effect an alliance between the Henry-barrel and the Martini-breech to give us the arm of the future. This was done; and as the composite arm exhibited no falling off either in accuracy or rapidity, the Henry-Martini rifle was definitely recommended by the Committee in their Report of Feb. 11th, 1869.

As regards accuracy, the following targets have been obtained with the Henry-Martini:—

	Averages of 5 Targets of 20 Shots each, from each Barrel.	The best of the 5 Targets at each range.	Corrected Angle of Elevation.		
			°	′	″
300 yards	·57 feet	·47 feet	0	38	34
500 "	·95 "	·79 "	1	1	26
800 "	1·63 "	1·29 "	2	2	29
1000 "	2·80 "	2·19 "	2	38	26
1200 "	3·46 "	2·28 "	3	55	34

To most of you, these figures will, no doubt, convey a sufficiently correct idea of the performances of the arm. But, for those who are not acquainted with the technicalities of rifle-shooting, a reference to this diagram (Plate xxi) will suffice to make it tolerably clear. Here is the Snider shooting, taken at its best at 500 yards. Here is the shooting of the Henry-Martini at the same range—about 25 per cent. better; and I should observe, that on several subsequent occasions even better targets have been obtained with the new arm.

As regards rapidity, a rate of fire, without aiming, of 20 rounds in 48 seconds—equal to 25 shots a minute—has been obtained, which is higher, I believe, than has been attained with any other gun, excepting guns which have sacrificed simplicity and other necessary military qualities to this one element of rapidity. The merits of the Henry shooting system such as low trajectory, penetration, non-liability to foul, endurance, &c., already established in the separate branch of the enquiry, of course remain in the composite arm; as do also those advantages of simplicity, resistance to injury from damp, sand, continued use, &c., which have been proved to belong to the Martini breech-mechanism. It may here be mentioned that 3,000 rounds have been fired from one action without producing any deterioration or perceptible alteration. The sighting of this rifle is somewhat different from that of the Enfield, the Whitworth construction having been adopted, and the back-sight having been slightly shifted in position—alterations which, it is believed, will enable the firer to take quicker and more accurate aim, especially in bad light, than the service-sights.

Some trials have been made between the Henry-Martini and Chassepôt rifles, with results largely in favour of the former. (The particulars are given in Appendix C.)

The cartridge, as I have stated, is the Boxer, and therefore we possess in this element all those qualities which have established the success of the service ammunition. The bullet is Mr. Henry's. It is solid, of a maximum diameter equal to that of the bore, ·45", and is made of lead hardened with tin, in the proportion of 1 of tin to 12 of lead; and the lubrication (pure beeswax) is disposed in a wad behind. There is a paper-cap over the bullet, lightly smeared with beeswax, to prevent leading. The weight is 480 grains. Weight of powder 85 grains.* Total weight of 60 rounds, 6 lbs. 4 oz. 2 drms., as against 6 lbs. 2 oz. 8 drms. for the service Snider-ammunition.

The cost of the new arm is estimated at £2 18*s.* 9*d.*, as against £2 13*s.* 2*d.* for a new Snider (of latest pattern). The weight is 9 lbs. 4½ oz., against 9 lbs. 2 oz.

It was not to be expected, nor was it to be desired, that a new arm should be proposed for adoption without attracting much criticism. It is one of the penalties which success has to pay. I recollect a gentleman whose horse had won a prize at the Horse Show, complaining that he never until that moment knew what a wretched brute he owned.

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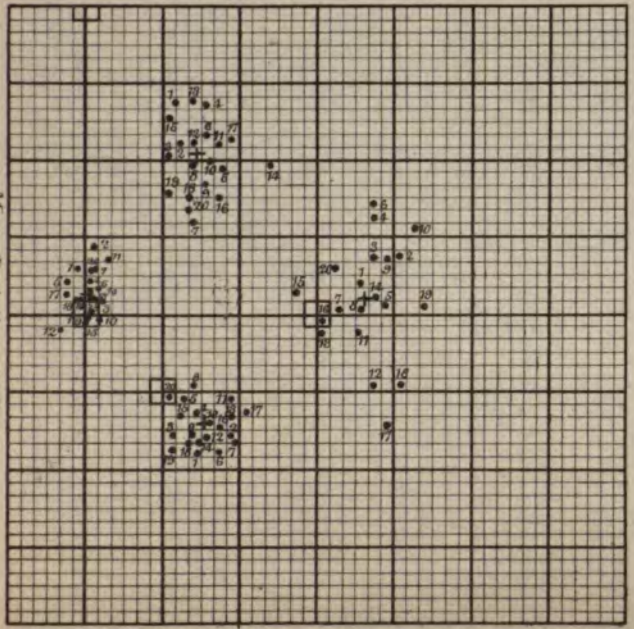
* Curtis and Harvey's "No. 6" powder was used in the competitive trials; but subsequently a suitable powder has been produced at the Government mills, at Waltham Abbey, with which equally satisfactory, if not superior, results have been obtained.

Unconverted Enfield at 500 yards
Mean Deviation = 1·56 Feet
or 18·72 In.

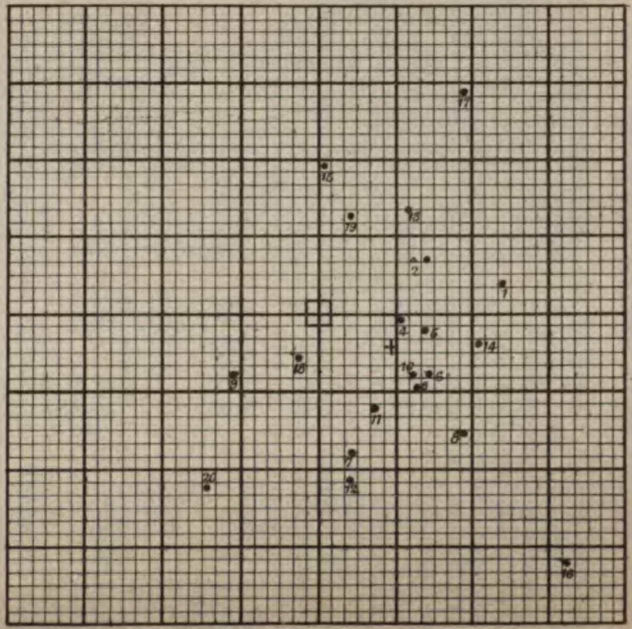
Martini-Henry { Mean Deviation = ·79 Feet
or 9·48 Inches



Mean Deviation = 1·07 Feet

Mean Deviation = 2·14 Feet

Mean Deviation = 4·69 Feet, or 56·28 In.



It was possessed, so observers pointed out, of every defect which goes to render a horse worthless; it was unsound from head to tail. I confess that having watched with some interest the very satisfactory performances of the Martini-gun for about two years, I have been surprised by the statements which I have met with since it was selected, as to its worthlessness. I read somewhere no less than eight vital objections to the system; and it was not until I had satisfied myself, by a careful re-perusal, that the writer had probably never seen a Martini-rifle, that I felt at ease. Seriously, however, the greater part of the objections which have been urged against the system, are totally without weight. Thus we have been told that the face of the block is necessarily convex, and that it therefore fails to afford to the base of the cartridge the requisite support. To this the simple answer is: It is not convex, as you will see if you examine this arm, but perfectly flat and lying dead true against the face of the cartridge.

Then it has been said that if you happen to pull the trigger before the block is closed, it will fire the cartridge. This objection must be met with a contradiction, the trustworthiness of which I can illustrate by the very simple experiment of snapping a few cartridges (empty of course, but having percussion powder in the caps), and you will see that they do not go off. Then it is said—but this was said by a critic evidently pushed for objections—that the empty case may be ejected into the face of the rear-rank-man. Is it worth while to point out that the force of ejection may be regulated as may be desired, and that there is no reason whatever why the front-rank-man should pepper his rear-rank in this way; and if he does, do you think the latter will be a serious sufferer?

I need hardly go through these alleged objections seriatim. But one must be noticed. Some persons strongly object to a spiral-spring. They say that it is uncertain, and liable to break, and will not efficiently replace the side-lock. If this is true, it is a very substantial objection; but there are *as yet* no grounds for believing it to be true. I cannot even discover upon what evidence it is supposed to rest. The spiral-springs have throughout the competition shown no uncertainty or liability to fail; and the Snider-rifle, which contains three of such springs, has not failed. The French and Prussians use spiral-springs, apparently to their complete satisfaction, for indeed, this appears to be about the only portion of the Chassepôt and needle-guns which it has not been proposed to alter. And a spiral-spring is a well-known mechanical application of power, and would hardly be so largely used in delicate instruments, if it furnished fluctuating and uncertain results. However, the best answer to this and the other criticisms is, that the arm will not be adopted for the service until these objections have been proved not to exist. It is intended to issue some of these rifles to the troops for trial in various parts of the world, and under all circumstances. If the objections exist, and if they cannot be overcome, then the contemplated adoption of the arm will of course be abandoned. If, on the other hand, the rifle gives satisfactory results in the hands of the soldier, its introduction will be confirmed. And this last is the result which I venture to predict.

Preparations are now being made for the supply of 200 hand-made arms, the whole of which will be ready by August next, and of which some are to be completed before the Wimbledon meeting. The plant at Enfield is also undergoing modification to adapt it to turn out Martini-Henry rifles, at a rate of about 400 per week, not later than the beginning of next year, and perhaps very much sooner. Thus the capability of the manufacturing departments to produce arms and ammunition in large quantities and of uniform quality will also be fully tested.

Before concluding, there are one or two matters incidental to the new arm to which I must briefly refer. There is, first, the question of the bayonet to be used. It is not disputed that the great multiplication in the rate of fire, which is the characteristic result of the adoption of an efficient breech-loader, must largely affect the question of the utility of the bayonet. The occasions have hitherto been rare on which troops have crossed bayonets *en masse*, or in which the bayonet has been actually called into play to repel a cavalry charge. Such occasions must henceforth be rarer still; and it is only in what we may call accidental instances, or in isolated personal contests, that the bayonet is likely henceforward to be used. But you may not deprive the soldier of this weapon altogether, and in determining the length and strength of his rifle you must still bear in mind that it may have to serve as the handle of a pike. These considerations have influenced the Committee in adopting an arm only four inches shorter than the Enfield rifle for general service; and in the substitution for the old bayonet of a weapon of more general utility. Here is the saw-sword bayonet which it is proposed to adopt with the Henry-Martini arm, and of which the general efficiency, whether as a bayonet, as a sword, or as a saw, seems to be sufficiently established by the experiments which have been made with it. Thus, a freshly-killed sheep, dressed in a soldier's great coat, has been thrust through with this weapon, through coat and wool, up to the hilt of the bayonet, smashing bones in its passage. It was then twisted about inside the sheep to test the security of the fastenings and the strength of the barrel. Then a butcher cut up the sheep with the sword, and, finally, sawed through the leg bone of an ox. The bayonet was driven 6 inches through a 1-inch white-pine door, and these two Norway spars of 2¼ inches and 3¾ inches diameter, were sawn through in 16 seconds and 1 minute respectively. Finally, this exceedingly tough piece of dry elm, 3 inches square, was sawn through, although in this instance of course the process was slow. So that the soldier will have at once a bayonet, a *couteau de chasse*, and a means of sawing firewood, and cutting up his rations, and be, therefore, more perfectly equipped than when armed only with an ordinary bayonet. These saw-sword bayonets are already used by the Irish constabulary.

One other point to be noticed in connection with the arm of the future is, the proposed trial of gun-cotton. So important a subject can hardly be worthily introduced at the end of a lecture; and I must assume that you are acquainted with the vast progress which, thanks mainly to Mr. Abel, has lately been made in this subject. I must assume that you are acquainted with the fact, which seems to have been most conclusively established, that gun-cotton, as now made, will be no more liable to spontaneous explosion than gunpowder; that it will not explode under about 300° Fahrenheit, which is practically as purely artificial a temperature, as that at which gunpowder explodes; and that by means of Mr. Abel's pulping process—the gun-cotton being reduced to pulp, like the pulp of a paper-mill, and afterwards compressed into charges of the required form and density, a combustion of a perfectly uniform character can be established; while by the dilution of this pulp, with some plain cotton pulp, or with a less explosive gun-cotton pulp, or by saturating the fibre with some inert varnish or deadening material, such as india-rubber dissolved in benzole, or similar bodies introduced into the fibre of the gun-cotton, the violence of the explosion may be considerably modified; and the varnish serves at the same time to render the material waterproof. What is now needed is, carefully and accurately to adjust these various conditions; to determine the weight of charge, its density, the amount and precise nature of varnish or of less combustible gun-cotton to be introduced; to determine in fact, by trial and error, the most efficient combination of the materials now lying ready to hand. This clearly is a matter for experimental inquiry, and you will, I am sure, be glad to hear that the subject has already been referred to a Government Committee. Assuredly, it is worth while to endeavour once for all, to determine the suitability of a material which would enable us to fight our battles without smoke; to use our rifles without even faintly fouling them; to reduce the weight and bulk of our ammunition; to be free from all liability to permanent injury by damp (as damp gun-cotton can be restored by simply drying it); and which would sensibly diminish recoil.

There is still one subject without some reference to which my remarks would be strangely incomplete. I have said that the revival of breech-loaders came exactly at the proper time, and as a sort of natural step or consequence in the development of fire-arms. If we trace in outline the history of weapons, we may observe this: First, there was the time when man attacked his enemy and his prey with the weapons with which nature had provided him. Then, probably immediately, came the epoch of auxiliary weapons—the fist weighted with a stone, the hand grasping a rude stick or club. Gradually these weapons assumed definite forms and a recognized importance. Their construction and use became methodized, as it were, and gave us fashioned side-arms of stone or flint, of wood and bronze, of iron and steel. The next development consisted in the introduction of missile weapons—the javelin, the assegai, and others to be thrown by hand, with feeble projectile weapons, such as the blow-pipe for projecting poisoned arrows, the bow, the cross-bow, and the sling. These weapons mark the connecting link between hand and fire-arms; and at this point, it may be noticed, body armour generally disappeared. Passing yet forward, we strike the track which leads directly down to our own age. The range of the blow-pipe and the sling and bow was so small, and their accuracy so imperfect, that the next improvements naturally took these directions. It is to the introduction of fire-arms that we trace the enormous development in both the range and accuracy of offensive weapons. And in these directions for many years men laboured; and the labours of Thierry, Delvigne, Thouvenin, Norton, and Minié at last fructified in the almost universal adoption for military purposes of the elongated rifle bullet, of great range and accuracy; and when the tide had once set in, it flowed strongly in this direction, and one inventor after another contributed his ingenuity to the perfecting of "arms of precision."

But there is a point beyond which nothing of practical utility remains to be accomplished in the matter of range and accuracy. The line has been drawn in England considerably in advance of the standard adopted on the continent, but wherever that line be drawn, there is the point beyond which it is practically useless to travel, and when this point is reached, men turn instinctively to the improvement of small arms in another direction. What then is the direction in which they will strive? Plainly, when the requirements of range and accuracy have been fully satisfied, the multiplication of the rate of fire, and the facilitation of its delivery, become the next objects to be accomplished. And thus we reach, as I have said, by a process of natural development, the "breech-loading" epoch; and if you should ask me to point you to the spring tides of these two last epochs, I would instance the two Paris Exhibitions—that of 1855 for the most remarkable novelties in "arms of precision;" and that of 1867 for the most remarkable expression of the "breech-loading" activity of the age. And then—looking forward—what is the next epoch; in what direction have we now to strive? If the next International Exhibition should be one of war, and not of peace, as is not impossible, what is likely to be its most distinguished military novelty?

Gentlemen, I think we can be in no doubt as to our answer. What we have now to do is to seek an efficient and ready means of defence for our soldiers against these terrible "arms of precision," which can pour forth such an amazing stream of fire, consuming all it touches. Most earnestly do I hope that this very important subject will not be neglected. We cannot, it is true, go back to "body armour," for no armour which a man could carry would resist a bullet capable of piercing $\frac{1}{4}$-inch iron. But we may by the establishment of a system of field entrenchment do much to afford cover and concealment to our men, and by an improved method of skirmishing do much to diminish their exposure. I confess I view with uneasiness the absence among us of any vigorous action in this matter—of any decided attempts to instruct our troops in the art of swiftly covering themselves, or to supply them with the means of doing so.* For, in my opinion, the nation which shall first grasp the full value of the necessity of the spade as an implement of warlike application, and which shall first reduce its use to an efficient system, will gain as great an advantage over its opponents, in degree if not in kind, as was conferred by the first possession of breech-loaders.

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* Since this lecture was delivered, the author has learned that a Committee has been appointed to consider this subject, together with points connected with drill and skirmishing.

APPENDIX A.

PENETRATION TRIALS OF HENRY ·45 INCH, EXPERIMENTAL ·5 INCH, AND SERVICE ·577 INCH BORES.

When fired through ½ inch elm planks, placed 1 *inch apart,*

The Henry ·45" hardened lead bullet made an average penetration of	14½ planks
The ·5" hollow lead bullet made an average penetration of	8½ „
The ·577" ditto „ „	8½ „

When fired through 3 *inch balks of dry fir timber, placed close together*, at 50 yards distance, the ·5" and ·577" Snider bullets were stopped by the second balks. The Henry ·45" bullets penetrated three balks easily.

At 100 yards distance, the Henry bullet also penetrated three balks easily, and a fourth balk of green fir having been added, making in all 12 inches of wood, two out of three bullets penetrated. Thus, whilst two balks of timber at 100 yards distance were proof against bullets from the ·5" and ·577" bores, four balks of timber at 100 yards were not proof against the Henry bullet from the ·45" bore.

When fired against iron plates, the following results were obtained:—

PLATE ·261" THICK.				PLATE ·125" THICK.
·577" bore	penetrated at	75,	not at 100 yards.	Failed at 300 yards.
·5" bore	„	100,	„ 150 „	
Henry ·45" bore	„	200,	„ 300 „	Penetrated at 500 yards.

When fired at a rope mantlet (four thicknesses of 3*-inch rope),*

The ·577" failed to penetrate at 50 yards distance.
The ·5" penetrated at 50 but failed at 100 yards.
Henry ·45" „ 350 „ 400 „

When fired at an ordinary gabion filled with earth from a clay soil,

The ·577" and ·5" failed to penetrate.
The Henry ·45" penetrated at 10 and 25 yards, but failed at longer distances.
The Jones (iron band) gabion was proof against all.

When fired at a sap roller,

The ·577" and ·5" failed to penetrate.
The Henry ·45" penetrated at 10 yards and at 25 yards, but failed at the longer distances.

When fired at a sand-bag containing one bushel of sand,

The ·577″ and ·5″ failed to penetrate.
The Henry ·45″ penetrated at 10 yards and at 100 yards.

The above is extracted from Report of Breech-loader Committee (1869), p. xviii.

In addition to the above, other penetrations have been made since the Report of the Committee was rendered, a detailed account of which are given in the *Proceedings Royal Artillery Institution.*—"Short Notes on Professional Subjects," 1869, pp. 80 to 83.

The conclusions drawn by Captain Noble from these experiments are as follows:—

(1) Steel plates offer a much greater resistance than those of wrought-iron.

(2) A steel plate of No. 5, Birmingham gauge, 0·217 inch in thickness, is proof at 10 yards against any small arm bullet likely to be used for some time to come.

(3) A wrought-iron plate of 0·312 inch thickness is not proof against the Henry bullet at 25 yards.

(4) A Jones's gabion filled with stiff earth is proof against any small arm bullet at 10 yards.

(5) A slight breastwork of filled sand-bags or loose earth is proof against all small arms.

(6) The rope mantelet used, gave unsatisfactory results.

(7) Two 3-inch planks of green oak are proof against any small arm bullet at 50 yards.

(8) The Henry bullet will pass through 12 inches of fir planks at 100 yards.

APPENDIX B.

RETURN of Boxer Cartridges, without Safety-Anvil (first pattern), which have exploded from accident or otherwise.

Date.	Place.	Cause of Explosion.
1866.		
October 1	Rl. Laboratory	A cartridge fell on iron standard and fired
„ 2	Do.	Upon placing cartridge in box to clean the bullet, it fired
„ 9	Do.	A cartridge fell on iron standard, and fired
„ „	Montreal	In the operation of unloading box from ship
1867.		
March 2	Rl. Laboratory	In the operation of heading quarter-barrel, a cartridge fired
August 14	Do.	Ditto ditto
October 1	Do.	Cap fired while chamber-gauging empty cases
1868.		
January 27	Do.	Cap fired by fall of empty cartridge on to the floor
February 7	Do.	Transferring Boxer ball in boxes returned from Canada, cartridge fired
January 20	Do.	Ditto ditto
February 17 ...	Do.	In ammunition returned from Canada one cartridge had fired
March 18	Do.	In operation of heading up barrel, containing blank converted from ball of Pattern I.
„ 4	Do.	While chamber-gauging blank cartridges, one fired
„ 18	Do.	In operation of heading up a barrel containing blank converted from Ball I.
„ 28	Do.	Blank returned from Canada for examination, in process of packing into bundles
April 1	Do.	Heading up barrel of blank, converted from No. I.
„ 3	Do.	Packing a bundle of ditto
August 27	Do.	Securing lid of box, containing Ball I. returned from Canada for conversion.

Some other instances of the same sort have occurred, but not having been accurately recorded, they are not included in this return.

APPENDIX C.

TRIAL OF IMPROVED CHASSEPÔT, FIRED IN COMPARISON WITH THE MARTINI-HENRY ARM FOR ACCURACY AT 500 YARDS RANGE :—

An unofficial trial of the Chassepôt, in comparison with the Martini-Henry rifle, has recently been made at the Proof Butt, Woolwich, by the Sub-Committee on Small Arms, with very satisfactory results.

Captain Simon, of the French Artillery, submitted for trial there improved Chassepôts, and they were fired in comparison with th Martini-Henry arm for accuracy at 500 yards range.

The results of the shooting were as follows: —

Arm.	By whom fired.	Mean deviation of 20 shots.
		Feet.
Martini-Henry, No. 3..	Serjeant Bott, R.M., kneeling position....	1·03
Chassepôt, No. 1.....	Captain Simon, from shoulder rest	2·78
Martini-Henry, No. 3..	„ „ „	0·97
Chassepôt, No. 1.....	Serjeant Bott, R.M., kneeling position....	3·02
Martini-Henry, No. 1..	Edward Ross, Esq., sitting position......	0·96
Chassepôt, No. 2.....	Captain Simon, from shoulder rest.......	2·78
Martini-Henry, No. 1..	„ „ „	1·62
Chassepôt, No. 2.....	Captain Mackinnon, sitting position......	2·38

Thus the accuracy of the Martini-Henry arm far excelled th Chassepôt.

Heights of trajectories of the two arms at 500 yards. Chassepô 10 feet at its highest point. Martini-Henry 8 feet 2 inches.

In simplicity of manipulation the latter arm is also superior.

20 rounds were fired for rapidity, with the following result:—

Chassepôt............	1 minute	42	seconds.
Martini-Henry........	0 „	48	„

The manipulation of the Chassepôt was found very fatiguing. I simplicity and strength of construction, the advantage appears to l with the Martini-Henry arm.

Captain Simon informed the Sub-Committee that the French soldi carries two spare spiral-springs, two needles, and one india-rubb washer, to replace any breakages or injury to these parts.

There were no mis-fires with the Chassepôt out of the few roun fired by the Sub-Committee, but after 10 rounds it became difficult push home the cartridge, owing to the clogging of the chamber. tl cartridges had to be forced in by blows, sometimes frequently repeate In the event of a mis-fire, there is no way of withdrawing the car ridge except by using the ramrod.

The ammunition of the Martini-Henry arm is slightly more bulk than that of the Chassepôt.

The weight of the 90 rounds is:—

	lbs.	oz.
Chassepôt	6	9
Martini-Henry	9	5

The bullet of the latter, however, weighing 480 grains, against 38 the weight of the Chassepôt bullet. The cost of the cartridge believed to be about equal.

The only advantage in favour of the Chassepôt is in the lightness of its ammunition. This is counterbalanced by the following points, which are in favour of the Martini-Henry arm:—

Increased strength and safety of ammunition.
Greater accuracy.
Longer range.
Flatter trajectory.
Higher penetrative power.
Greater safety, strength and simplicity of construction.
Increased rapidity of fire.

(From *Proceedings R. A. Institution.* "Short Notes on Professional Subjects, 1869," pp. 79, 80.)

DESCRIPTION OF PLATE XX.

a. Barrel
b. Body
c. Block
d. Block axis-pin
e. Striker
f. Main-spring
g. Stop-nut
h. Extractor
i. Extractor axis-pin
j. Rod and fore-end holder
k. Rod and fore-end holder screw
l. Ramrod
m. Stock fore-end
n. Tumbler
o. Lever
p. Lever and tumbler axis-pin
q. Trigger-plate and guard
r. Trigger
s. Tumbler-rest
t. Trigger and rest axis-pin
u. Trigger and rest-spring
v. Stock-butt
w. Stock-bolt
z. Lever catch-block spring and pin
A. Locking-bolt
B. Thumb-piece

LECTURE.

Friday, May 18th, 1869.

REAR-ADMIRAL SIR FREDERICK W. E. NICOLSON, Bart., C.B.,
Vice-President, in the Chair.

THE USE OF THE COLLIMATOR FOR LAYING GUNS FOR NIGHT-FIRING.

By Lieut.-Colonel D. DAVIDSON, late Bombay Army.

IN regard to my plan for laying guns and mortars which I am about to explain, I may say in the first place, historically, that it was suggested during the siege of Sebastopol to meet a difficulty felt by the attacking party. The Russians were in the habit during the night of repairing the damage done to their works by our batteries during the day, replacing the silenced guns by fresh ones, and so presenting insuperable difficulties to an attack. This led me to offer, by the help of the very simple apparatus now to be described, so to register the aim taken at the object with the ordinary sights as to be able to restore it without again sighting the object, and thus to maintain an accurate and effectual fire throughout the darkest night. Of course the practice could by the same appliance be continued during the day with the embrasures closed, and the gunners protected from the fire of the enemy, and all this by means of a much more rapid and easy mode of laying than that with the ordinary sights.

The system was subjected to careful trial at Woolwich by the Select Committee, and approved of, and between 30 and 40 sets of the instruments were ordered out to the Crimea; but owing to unfortunate obstructions which I met with at an earlier stage, and over which I had no control, Sebastopol was taken before the instruments had left this country. They were then distributed for practice among some of our Artillery stations at home and abroad. But the invention

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Fig. 1.

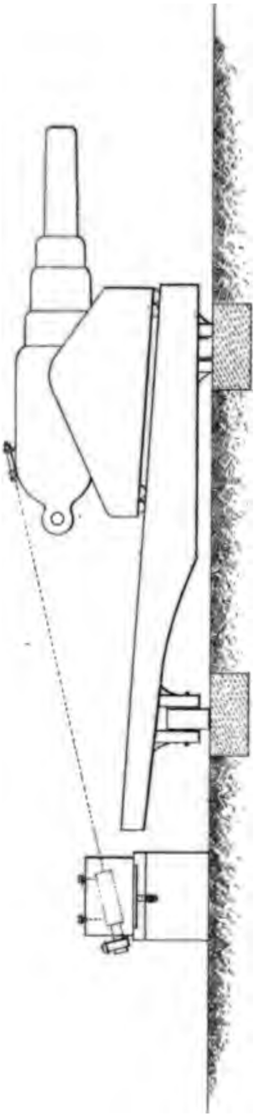


Fig. 2

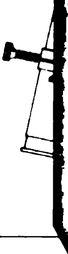


Fig. 3

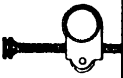


Fig. 5

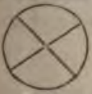
Fig. 6.

ears to have been allowed to fall into a happy state of slumber, m which it is my present object to awaken it, especially with a view its application to the Moncrieff system, to which I shall afterwards er.

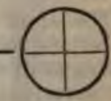
The apparatus consists of a telescope temporarily applied to the ce, and looking backwards or behind it, where, at a short distance, t clear of the recoil, is fixed a collimating telescope, whose cross lines to be bisected by those of the first telescope. (See Fig. 1, Plate xxii.) e accuracy of this plan is vouched for by its frequent use in ronomical observatories. The practical arrangements for securing sufficiency and fitness for the present purpose are now to be cribed.

The apparatus consists of two parts—the telescope and the collimator. The telescope is achromatic, of an inch aperture, and about ven inches long (see Fig. 2). At each end of its tube is fixed a lar, that at the eye-end (Fig. 3) has an elevating screw pointed at lower end, and capable of being clamped when the telescope has n adjusted to the collimator. The collar at the object end of the escope (Fig. 4) has two screw feet, the shorter of which is pointed. the fourth lens from the eye end of the telescope a cross is cut

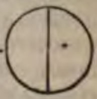
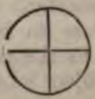
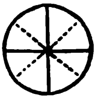
s —



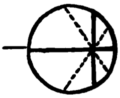
To make this telescope available for any gun, the gun should be "point-blank" at any conspicuous object. The telescope is then ed upon the gun, with the front collar resting on the "base ring," he right, and just clear of the "vent field," and ordinary sight (see s. 2 and 4). The eye-end of the telescope is now moved, and the ating-screw turned, till the object at which the gun is pointed is by the cross, as seen diminished by looking in at the object or erse end of the telescope. A mark is then made on the gun where point of the elevating screw touches it; and at that point a small e is punched in the surface of the gun, sufficient to receive the rp point of the screw. The point of the screw is now placed in s hole, and the telescope adjusted as before, so that the cross ersects the object, and the position occupied by the pointed foot at object-end being carefully marked, a longitudinal cut in the ection of the axis of the gun is made with a cold chisel, deep enough receive the pointed foot. It is made longitudinal here, because as I vate or depress this screw, I increase or shorten the distance ween the points, so that two round holes would not suit. By this angement the axis of the telescope is placed parallel to the axis of gun, or sufficiently so for practical purposes; and if removed replaced, the axis of the telescope maintains a constant relative ition to the axis of the gun. For example, if I were to intersect minute object with the telescope, when so applied to the gun, and n take it off and put it on again, I should find the object intersected the same as if the telescope had never been moved.

The collimator consists of an achromatic lens of about 3½ inches aperture, and about 15 inches focal length, mounted in a square wooden tube. (In Figs. 1, 5, and 6, it is shown placed on the top of its packing box ready for use.) At the other end of the tube is a disc of glass, 1¼ inch in diameter, secured in a brass tube, and having a cross cut on it, thus:—  To illuminate this cross, a tube with a diagonal reflector is fixed to it for day-use, and a small lantern, having a piece of ground glass to disperse the light, is substituted for the reflector for use during the night. This telescope or collimator is suspended in a wooden case (open at both ends) by means of two long screws, the milled heads of which appear above the top of the case. By turning these milled heads the collimator is raised or lowered, and placed at any required angle. A pivot (p) attached to the tube enters a vertical channel cut in the inner sides of the case, and two brass springs fixed to one side of the tube press it against the opposite side of the case, and keep the tube steady. When in use, the collimator is placed on the top of its packing box, to which it is secured by a thumb screw at each end, which are so arranged as to admit of the collimator being moved to either side on the horizontal plane, or angularly in that plane, and there clamped. Thus the collimating telescope has motion in every required direction.

To Use the Telescope and Collimator.

The gun having been laid during the day by means of the ordinary sights on the object to be struck, the collimator, fixed to its packing-box, is placed on the ground in rear of the gun and clear of the recoil. (See Fig. 1). The telescope is then applied to the gun in the manner already described, and the elevating-screw is turned till the cross in the telescope is level with the centre of the object-glass of the collimator. The collimator is then moved, packing-box and all, till the object-glass is nearly in the cross of the telescope, and a minute lateral movement is then given to the collimator on the packing-box, by tapping it with a hammer. When the object-glass of the collimator is thus brought into the centre of the cross, the farther end of the collimator is moved by tapping to either side till the perpendicular line of its cross appears in view, and gradually reaches the centre of the field, thus:—  The farther end is then elevated or depressed as the case may require, by means of the screw, till the horizontal line appears in the centre, thus:—  The collimator and telescope are then minutely moved till the crosses in each intersect thus:—  In this position the collimator is secured firmly to the packing-box by the clamping screws. The elevating screw of the telescope is also clamped, and the telescope removed.

The collimator and telescope having been in this manner adjusted to the aim of the gun, the gun may be fired, loaded, and run up. The telescope is then applied as before, and the gun is now moved till the cross in the telescope bisects the cross in the collimator, when the gun will have been restored to the position in which it stood before the shot was fired, or else into one exactly parallel to it in every respect, which for all practical purposes is the same thing.

The collimator sends out a column of parallel rays, each giving an image of the cross in the focus, any one of which may be used for registering the aim of the gun. If I take a central ray, then I get my intersection in the centre of the field of the collimator. But if the gun has been moved several inches to one side, I find, perhaps, that the ray I meet in the collimator is on one side of the field thus:— 

But still, I can make my intersection there, and I get the gun then laid perfectly parallel to its first position in the horizontal and vertical plane; so that, if there is an error, it is a parallel error just amounting to the extent to which the gun has been moved—perhaps an inch or an inch and a half—and it will strike the object an inch or an inch and a half on one side, supposing the gun to shoot perfectly true.

If long intervals occur between the rounds, the gun should be restored to aim immediately after firing, so that in the event of an accident or a shot disturbing the position of the collimator, it can be re-adjusted to the gun, or, if destroyed, it can be replaced by another.

In elevating the eye-end of the telescope to make it point down towards the collimator, it is evident that the axis of the telescope is no longer parallel to the axis of the gun in the horizontal plane. This, in the event of the platform losing its level position, would involve an error similar to that which occurs when using the tangent scale under the same circumstances. But this error is of little consequence except when the gun is fired with high elevations. In such cases, the error can be entirely obviated without levelling the platform, by merely unscrewing the elevating-screw of the telescope till its axis is parallel, or nearly so, to the axis of the piece, and then raising the collimator to meet the telescope, which can be readily done by means of a pillar of stones and mud, or by a gabion cut to the requisite height and filled with earth.

To give steadiness to the collimator it is well to put two or three shot into the packing-box.

Before describing the application of the instrument to mortars, I may as well show practically, by means of the model gun upon the table, how the aim is registered and restored.

Suppose this gun to be laid by the ordinary sights upon the object. I apply the telescope to a hole and cut in the gun already described, and an assistant moves the collimator till the intersection of the crosses is made. The aim is now registered and the collimator clamped. The gun is now fired and completely displaced, as I now displace the model. I run it up as nearly as I can guess to the position it occupied before it was fired, and, as you see, apply the telescope and look through it into the collimator. I find the crosses no longer intersect, so I move the gun instead of the collimator till the intersection is made. It occupies, as you see, only a few seconds, and now the gun is ready to fire. If fired, and the gun perfectly accurate in its performance, the shot will hit in exactly the same place as the first, because the gun is mathematically restored either to the same position or to one exactly parallel in every respect to that in which it originally was laid. I need not say that the simplicity of laying is very great, because you have these two crosses, minute in themselves, but magnified as large as the cross-bars of the window, to divide each other. You might pick up a boy in the street and teach him in five minutes to lay the gun as well as the most skilled gunner you can produce.

The Application of the Instrument to Mortars.

In the case of mortars, a small spirit-level is attached to the telescope, which is mounted, and applied to the mortar in the following manner:—

The telescope is attached to the upper part of an arc of gun metal by a strong joint which can be clamped at any angle (see Figs. 7 and 8). This arc has a flange (*f*) along its outer edge, which receives in its angle two cylindrical-headed studs half an inch in diameter and half an inch high (*s s* and *s*, Figs. 7 and 8). These studs are 3½ inches apart, and are screwed into the muzzle or face of the mortar, half an inch from its upper edge. The screw-foot at the lower extremity of the arc adjusts the face of the arc into a position parallel to the muzzle of the mortar, and when the arc is placed so as to hang upon the studs, it circles round this screw-foot as a centre, till the bubble is in the centre of the level.

The collimator used with mortars is of the same construction as that already described for guns, but is not quite so large.

To use the Telescope and Collimator with Mortars.

Lay the mortar in the usual manner. Apply the telescope to the studs, and move it gently on them till it is level. Elevate or depress the telescope till its cross is on a level with the centre of the object-glass of the collimator which is placed on its box in front of the mortar under shelter of the epaulment. Adjust the collimator in the manner already described, so that its cross shall bisect the cross of the telescope. The collimator is then clamped, and remains a fixture while the firing continues, and the telescope is removed.

The mortar having been fired, it is loaded and run up as nearly as possible (as shown by a chalk mark on the platform) to its original position. The telescope is replaced on the studs and moved till level, and the mortar is then moved forwards, backwards, or to one side, till the intersection of the crosses is made, when the aim will be exactly restored.

On an emergency, the studs in the muzzle of the mortar may be dispensed with, and the flange of the arc can be placed on the upper edge of the muzzle.

I should like to explain in a few words one great advantage this method of laying a mortar has over the present system. To lay a mortar under the present system, two points are placed in front of the mortar, carefully aligned in the direction of the object to be struck. Having found the exact centre of the mortar by means of a spirit-level, and drawn a chalk mark in the line of its axis, an attempt is made, by means of a plumb-line, to make the axis of the mortar coincide with the two points in the vertical plane. Now to restore the mortar truly, it must be brought back after every discharge to this identical line, and this is no easy matter, as in traversing right and left, there is constant liability to pass beyond the line. Whereas by the use of the collimator, we have, instead of one line on which to bring the axis of the mortar, a whole column of lines or rays, in any one of which, the mortar may be laid in a parallel position, while the elevation of the piece is restored with mathematical exactness. This method of laying a mortar is also exceedingly rapid.

Telescopic Sight for Cannon.

The telescope used in conjunction with the collimator is so constructed that it can be made available for giving the aim, by looking through it directly at the object to be struck. In the upper side of the shoulder of the left trunnion of the gun a hole is made to receive the point of the elevating screw of the telescope. In front of the trunnion, at the proper distance, a bracket (Fig. 9) is fixed for the feet of the front collar of the telescope to rest on. This bracket is made of gun-metal, and is fixed to the gun by screws, in the same manner as the fore-sight (see Figs. 10 and 11). In the upper step of the bracket there is a dovetail slide (*z* Fig. 9), which can be fixed by a pinching-screw when the telescope is adjusted to the axis of the gun. In the upper surface of this slide a longitudinal channel, similar to that on the base-ring, is formed to receive the shorter foot of the front collar, while the longer foot rests on the lower step of the bracket, and gives steadiness to the telescope. The distance between the point of the elevating-screw and that of the shorter foot of the front collar is so regulated, with reference to the thread of the elevating-screw, that one turn of that screw is equal to one quarter of a degree of elevation.

One side of the elevating-screw being flattened, the degrees are marked off on it, and one or more turns of the screw give the quarters.

The adjustment of the telescope to the gun is made by bringing the gun point-blank on a distant object, by means of the ordinary sight. The elevating-screw of the telescope being fixed at the zero of its scale, its point is inserted in the hole of the stud in the trunnion, and the shorter foot of the front collar is placed in the channel of the dovetail slide, while the longer foot rests on the lower step of the bracket. The object at which the gun is pointed, is then viewed through the telescope, and the screw feet in the front collar are turned till the intersection of the lines in the telescope is exactly the height of the object. The horizontal adjustment is readily effected by moving the dovetailed slide (*z*), which is then securely fixed by the pinching-screw.

Advantages of the Telescope and Collimator.

The most obvious advantage of this apparatus is that it affords the means of continuing the fire of guns and mortars throughout the night with as much precision as can be attained during the day; thus preventing the repair of works and the replacement of guns in the night. Indeed, by means of the telescope and collimator, the fire of batteries might be maintained solely at night, or during the day under cover of smoke and fog, when the enemy, unless similarly provided, could not return an equally effective fire.

As the use of the instrument admits of the embrasures being closed, except at the moment of firing, the men who work and point the gun are not exposed to the direct fire of the enemy.

The laying of a gun or mortar by the collimator is rapid, easy, and mathematically accurate. The crosses being in the same plane of vision, and greatly magnified, their intersection is much more obvious and distinct than the alignement of the ordinary sights with the object; and can be effected as well by a short-sighted person as by one whose vision is perfect.

In making experiments to test the accuracy of different kinds of ordnance and variously shaped projectiles, an important source of error, that of pointing, may be got rid of, by using the telescope and collimator to lay the piece.

The arrangements I have now described had reference to a particular emergency, and during the eleven years which have elapsed, great improvements have been made, not only in guns, but in the methods of laying them. To one of these, the Moncrieff system—the advantages of which have been fully established—I believe the use of the telescope and collimator would form a suitable adjunct, more especially when that system is applied to guns in position in field or siege operations. Captain Moncrieff has made provision for doing the same thing in permanent batteries by means of a trunnion-pointer and graduated-racer. When that system is employed in siege operations, field operations with guns of position, or in temporary batteries with manner already described, so that its cross shall bisect the cross of the telescope. The collimator is then clamped, and remains a fixture while the firing continues, and the telescope is removed.

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Davidson brought it forward, he fell on evil days, on times when our minds had not become accustomed to the refinements in artillery practice, necessitating that precision of laying guns which we now aim at. Although the Government actually sent out ten of these instruments to different stations, I never could learn that they were used; at least, I only knew of one instance in which they were used. The general reception they met with was, that people understood them, but would not be bothered with them, and went on aiming in the old way. There is always a tendency to that kind of preference for rough and ready measures; we find inventions of this description disregarded in the excitement of action. But if occasions of service should again arise, the Officers of the Royal Artillery are now perfectly well prepared to appreciate the advantages of the collimator; and if I had anything to do with such matters, it would be my desire to see it used in all suitable cases. I am satisfied it will give extreme accuracy in laying guns, combined with those conditions of security which the use of arms of precision now renders so necessary.

Captain MONCRIEFF: I should like to make one or two remarks about this instrument, as I have been acquainted with it for some time as applied by Colonel Davidson. Whatever its value may be as used for guns, there is no doubt that in mortar practice it would be of very great importance. We all know that the present method of laying mortars is a very rude and troublesome one. I am sure that artillerymen would gladly avail themselves of this instrument for sustained fire if they were acquainted with it. The adjustment is rapid, and the aim extremely correct. A mortar battery should be considerably below the crest of the parapet, and out of sight, involving the necessity for taking aim by means of pins, lines, &c., which is one of the most awkward operations as now applied, which I know of. I am therefore inclined to think that the Artillery would gratefully receive the collimator when they became acquainted with its advantages.

The CHAIRMAN: If no other gentleman has any observations to make, I am sure we shall all be happy to return our thanks to Colonel Davidson for the clear manner in which he has brought this subject before us. If it had no other effect than to draw forth the few remarks which General Lefroy has made, it would have answered some good purpose. I am sorry to say that for the Navy the collimator is not applicable, but for firing at fixed objects, I have no doubt it might be brought very much into use, as General Lefroy has remarked.

any kind of guns, the collimator might prove a useful adjunct, as it would give accurate results in all conditions.

As regards the methods of making this application of the collimator, that would be a matter for future arrangement; but I shall briefly indicate a plan that seems suited to the purpose.

Fig. 12 is a sketch of the Moncrieff gun, on which at *a* the position of the collimator is marked with dotted lines. In this case, as suggested by Captain Moncrieff, the collimator is fixed permanently to the gun, instead of the telescope being temporarily applied to it. The collimator has its axis parallel to the axis of the gun in the vertical plane, and need not be so large as in the other case. It has its cross illuminated by a small lantern. The telescope may either be attached to a heavy movable stand placed on the opposite side of the pit, or it may be clamped to any convenient part of a circular rod running round the edge of the pit. In either case the telescope would have a means of rapid and minute adjustment in the horizontal and vertical plane by something like a slide rest arrangement, so that by intersecting with its cross lines the cross in the collimator, it could register in a moment the laying of the gun. When the gun is fired, reloaded, and brought up to the firing position, it is probable, from its construction, that, on looking through the telescope into the collimator, it would be found that very little adjustment was required, and the intersection of the two crosses would be very rapidly made, under the direction of the observer at the telescope, by the men working the gun.

As at short ranges in siege operations, the muzzle of the Moncrieff gun would be exposed to the fire of the enemy at the time of laying, it is important this should be made as rapid as possible; hence the advantage of the collimator. Further, as the gun can be relaid by the collimator without sighting the object, the muzzle might be protected during the time of laying by the iron shield balanced at *b*, Fig. 12, and worked by a rod, *c*, from the inside of the pit. By such an arrangement as this, I can conceive the Moncrieff gun to be made perfectly impregnable.

The CHAIRMAN: If any gentleman wishes to make any observations we shall be happy to hear him.

Major-General LEFROY, R.A., F.R.S.: I had the pleasure of having some official intercourse with Colonel (then Major) Davidson about fifteen years ago, when this subject was first brought forward, and I then formed an extremely favourable impression of it, which I retain. The application of the principle of the collimator is exceedingly happy; it is a familiar thing to astronomers, in connection with fixed instruments, as a convenient way of adjusting two axes of any kind, whatever their distance from one another. The collimator of Colonel Davidson is actually in the service, although probably few people are aware of it. It does not often happen in any description of warfare that we are firing at fixed objects. It may be said to be confined to siege operations and to the defence of fortified places. For some years past our minds have been principally directed to coast defences of all kinds, where we have to fire at moveable objects, and where, consequently, an arrangement of this kind is inapplicable. But if such a siege as that of Sebastopol were to occur again, I have no doubt that this instrument would be employed. It was introduced into the service in 1863, and stands among our special provisions for certain occasions. When Colonel

After the failure of all other means, recourse can be had to the force of explosives to effect removal, and there are many instances on record of such demolitions.

I propose to give a short account of some of the principal recorded examples of destructions of wrecks, and to point out the advances which have been made in the art of submarine-mining, since operations of this description were first undertaken.

As far as I am aware, the earliest instance of the application of gunpowder to the destruction of wrecks was in 1831, when a vessel of 350 tons burden, named the "Arethusa," sunk in the harbour of Barbadoes, was blown up by a party of the Royal Sappers and Miners, under Major Reid, R.E. It appears that at low water, this ship was nearly dry, and that in consequence charges were lodged against her without difficulty. I have been unable to find any record of the details of the operations, beyond the statement of these bare facts, and that small charges were made use of.

In 1833, Mr. Abbinett, a celebrated diver, blew up part of the wreck of the "Boyne," off Portsmouth, with two charges, one of 630 lbs., and the other of 200 lbs. of powder. The large charge was held in an oil-hogshead, and was ignited by two slow matches each 45 feet long, protected by leaden-tubes reaching to the surface.

About this period also submerged charges of gunpowder were used at Plymouth in blasting rock; these were ignited by pieces of red-hot metal dropped down tubes from the surface.

The most important of the early demolitions were those of the brig "William" and the schooner "Glenmorgan," both of which foundered in the Thames near Gravesend in 1837, and that of the famous "Royal George," at Spithead. These removals, together with that of the "Edgar," at St. Helen's, were all executed by Colonel, afterwards Sir Charles Pasley, R.E.

Before undertaking the destruction of the wrecks in the Thames, Colonel Pasley recommended that efforts should be made to raise the sunken ships, and stated his opinion that it was preferable to weigh sunken vessels entire if possible, than to blow them to pieces, and weigh the fragments afterwards. Application was accordingly made to the Naval authorities, the result of which was, that the Master Attendant of Chatham Dockyard received instructions to lift the ships, and was despatched to Gravesend with the needful gear. After some weeks spent in fruitless labour, the attempt was given up on account of the great weight of the vessels, their cargoes consisting respectively of coal and iron; it was therefore decided to fall back upon the original plan of destruction by gunpowder.

Since the year 1812, Colonel Pasley's attention had been directed to the art of blasting under water, which was at that time very little understood, and he carried out a series of experiments with small charges of powder in the Medway, with a view to ascertain the best mode of ignition at considerable depths. Bickford's fuze had been used with great success in shallow water, but was found to be uncertain at depths of 10 or 12 fathoms; its slow rate of burning also rendered it objectionable. He ultimately came to the conclusion that nothing was preferable to a small linen-hose filled with powder and enclosed in a leaden-pipe leading from the charge to the surface, and there supported by buoys. The hose burnt uniformly at the rate of 10 feet per minute, its diameter was $\frac{1}{10}$th inch and that of the pipe 1 inch. The top of the latter of course stuck out of the water, and after ignition, the smoke issuing from it, gave an unfailing indication as to whether the hose was burning properly.

Having settled this point, Colonel Pasley commenced his preparations. He determined to attack the "William" first, knowing her to be strongly constructed, having been built as a vessel of war. He proposed to use two large charges of gunpowder, each of 2,500 lbs., and placed on opposite sides of the ship, not exactly amidships, but one rather nearer the head and the other nearer the stern. These he anticipated would be sufficient for the purpose.

The cases to contain these large charges were built in Chatham Dockyard, and were similar in construction to large mooring buoys, but strengthened at the ends to enable them to resist the pressure of the water. Though of themselves perfectly watertight, it was deemed prudent to enclose within each of them a second water-tight cylinder of sheet lead, the dimensions of which were 3 feet in diameter, and 6 feet 2½ inches long. Three holes were provided in each cylinder; in the middle hole was inserted a short leaden tube, closed at the bottom, and perfectly water-tight. This tube was open to the outside and its closed end led to the centre of the great charge, with which however, the tube had no communication. The object of the tube was to hold a small bursting-charge, which should be ignited directly by the powder-hose, and by its explosion open the tube and fire the great charge. By this precaution the large mass of powder in the cylinder would be saved in the event of any accident happening to the lead tube and the water finding its way into the powder-hose, which would not be the case were the hose to lead direct into the body of the charge. The two other holes were for filling the cylinder with powder, after the completion of which operation they were hermetically closed by plates of tinned metal soldered over them.

The diving-bell and divers in helmets were employed in examining the wreck. The latter appear to have been found the most useful, the space covered by the bell being very limited. The apparatus was, however, much more clumsy than that now in use, and a corporal of the Engineers, who was the first diver sent down, became entangled at his second descent, and died before assistance could be rendered to him.

The operations were commenced by mooring a lighter immediately over the wreck. A strong rope, sunk by weights, was then led entirely round the hull, and the ends secured so as to clasp it tight. Pulleys had been previously attached to the rope at the points at which it was intended to lodge the great cylinders, and small ropes passing through them served as downhauls to get them into position. The depth of water was 60 feet. So unwieldy were the great cylinders that considerable difficulty was experienced in manœuvring the first and getting it down, but it was at last secured, and after clearing away the lighter and small craft, the powder hose was ignited. Very soon afterwards the water got in at the top of the pipe and put the hose out, to the great disappointment of all concerned, as well as of the spectators, thousands of whom had congregated on the banks. Matters were further complicated by a large ship, which in the course of the night ran foul of the lighter and carried away the leaden tube. Next day the charge was raised and found to be dry, thanks to the small tube containing the bursting charge, which alone had suffered: it was therefore prepared with a fresh hose, again lowered, and fired successfully. The explosion destroyed so much of the wreck that it was not considered advisable to waste the other great charge in breaking up what remained, and the demolition was completed with smaller charges. A charge of 350 lbs. was prepared, contained in a tin case enclosed in a cask, but the water got in and drowned it. A similar charge was also lost in the same way. Finally the demolition was completed by fifteen charges of 45 lbs. each, enclosed in 5-gallon tin oil-bottles, and fired with short lengths of Bickford's fuze.

The schooner "Glenmorgan" was next examined. She had gone down several years before, and was not so much in the way as the other, indeed it is probable that had it been found necessary to expend the second cylinder upon the brig she would not have been blown up at all. The divers reported that she lay low in the mud, but that a gully had been swept all round her by the wash of the tide, reaching on the port-side nearly to her keel. Advantage was taken of this peculiarity, and the large charge of 2,500 lbs. was lodged in this natural trench exactly opposite the centre of the ship. The depth of water was not so great as in the other case, being only 40 feet at low tide. The same arrangements as before were made for firing, and after one failure due to a defect in the leaden tube, the charge was exploded successfully and completely dispersed the wreck.

The total expense of removing these two vessels amounted to £400. The operations excited a good deal of curiosity at the time, many people doubting the possibility of exploding gunpowder under water at all. The Lord Mayor and Court of Aldermen marked their approval of Colonel Pasley's success by presenting him with the freedom of the City in a gold snuff-box of the value of £50. It is a significant testimony of the advance of this particular branch of science that now, after 30 years have elapsed since this testimonial was presented, undertakings of the same nature, but on a much larger scale, are entrusted to junior subalterns of Engineers as part of their ordinary duty.

In his report, Colonel Pasley frankly admits that he was guided by no rule in determining the amount of powder required to effect demolition, which is plain from his evident intention of using 5,000 lbs. to blow up the "William," little more than one half of which quantity turned out to be enough. But it must at the same time be remembered that he had no former results to guide him, and feeling his way in the dark he was resolved to err in excess rather than fail in his object through unwise economy. Moreover, the laws of submarine explosions were at that time very little understood, and the only available experience was derived from a small number of meagre experiments. Viewed by the light of our present knowledge, these arrangements present grave defects. Leaving out of consideration the method adopted to ignite the charges, we see that the same amount of powder would have done much more work had it been used in smaller quantities. In all descriptions of submarine explosions, a great point is always made of the vast column of water and mud, of such and such estimated diameter and so many feet high, thrown up into the air, the writers appearing to overlook the fact that the object of the explosion is not to raise the greatest possible column of water, but to do the greatest possible amount of work below, and that such a column represents with tolerable accuracy the quantity of power wasted. This being the case, it is now usual to regulate the size of charge by the depth, using such a quantity as just fails to break the surface of the water, by which means the maximum of effect is obtained. Cases sometimes occur in which it is expedient to deviate from this rule, for instance in very shallow water, where charges so calculated would be too small, but it is acted on as a broad principle.

Another objection to these charges of a ton weight is this: a case which would hold the powder and keep the water out, appears to have been considered perfect. Now we know by actual experiment that gunpowder does not explode instantaneously, but that its combustion proceeds at a very rapid rate from the point of ignition through the whole mass. In the case of a charge fired under water, unless a very strong envelope is used to confine the explosion, as it were, and allow the whole mass to ignite, the firing of the first half dozen pounds is sufficient to open the case, when the water rushes in and drowns a large proportion of the rest. The evil is partially remedied by providing a great number of centres of ignition, whereby the charge can be fired at many points simultaneously, but even this artifice does not remove the necessity for great strength in the external case. A number of experiments on this point have been carried out in connection with the question of torpedoes, from which it appears that unwieldliness and weight are the only considerations which limit the strength that may be advantageously given to these envelopes. It has been also laid down that 250 lbs. of powder is the maximum which should ever be fired from one centre. I have no hesitation in saying that of the 2,500 lbs. in each of Colonel Pasley's cylinders, not one half exploded.

Encouraged by the success which had attended him in the destruction of these two wrecks, Colonel Pasley was induced to undertake the formidable task of removing the "Royal George." The history of this ill-fated vessel is well known. Suffice it to say that she lay at the bottom at Spithead in 80 feet of water, and had for half a century proved a great annoyance to mariners from the frequency with which she was fouled by the anchors of ships bringing up in the roadstead.

Before sending in his estimate of the probable expense of this great work, Colonel Pasley instituted a series of experiments at Chatham, to determine the form of diving-bell best adapted for employment in a strong tideway, and also the feasibility of applying voltaic electricity as a means of igniting submerged charges. The first question was settled to his satisfaction by the addition of pointed ends to the original square form of the bell, the result of which was, that perfect steadiness was secured in a current running 3½ knots an hour, a velocity considerably greater than was known to exist at Spithead.

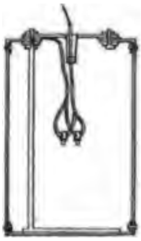
With reference to the adoption of voltaic electricity for the firing of gunpowder, I may mention that this method depends for its principle on the heating of a small filament of metal by the transmission of a powerful voltaic current, which effect is due to the resistance offered to the current by the minute sectional area of the conductor, through which it has to pass. Platinum is the metal best suited to the purpose, as its great ductility allows of its being drawn into very fine wire, and the high temperature at which it fuses, permits it to become white hot without breaking. The principal drawbacks to the employment of this fuze are these. It can only be used within a comparatively short distance of the battery, as the resistance of the main conducting wires is so great, that the current rapidly loses its energy as the length of the conductors which it has to traverse is increased. To generate a current of sufficient quantity, a large battery must be used, involving the employment of jars to form the cells, and bottles to contain the acids, which, for rough work, are liable to get broken, while at sea the liquids are apt to be spilt. It is impossible to ascertain the state of the fuze, or conducting wires, by testing after submersion. Still, in spite of these disadvantages, the employment of the platinum-wire fuze was a great step in advance of the powder-hose or Bickford's fuze, and the result of the experiments was, on the whole, so much in its favour, that it was decided to employ it at Spithead, using for conductors insulated copper wires of ⅛th inch in diameter, and for the source of electricity, Professor Daniell's constant battery. It was ascertained that fourteen cells of the pattern adopted were capable of firing powder at a distance of 2,000 feet.

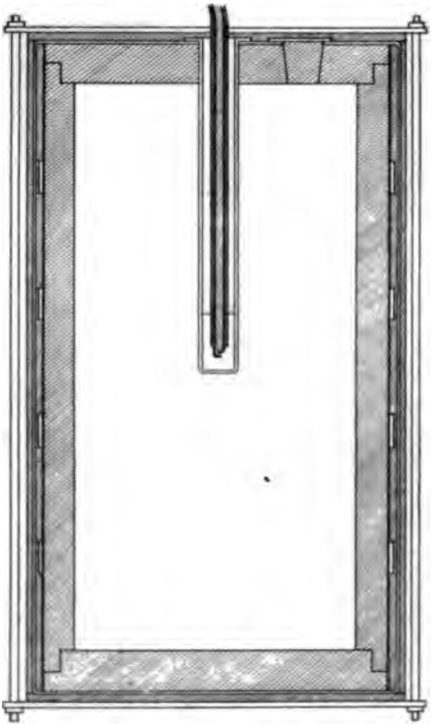
Fully satisfied with these results, Colonel Pasley framed his estimate, amounting to £2,500. It was known that the value of the guns alone of the "Royal George" was £5,000; so that, supposing only half to be recovered, the work would pay itself.

As soon as the necessary authority from the Board of Ordnance had been received, four large cylinders were ordered to be built at Chatham Dockyard, capable of containing 2,500 lbs. of gunpowder each, the same size, in fact, as those used in the Thames. An improvement was, however, introduced, by the transfer of the leaden protection from the inside to the outside, it being evident that, with the old cylinders, in the event of water penetrating the external wooden case, the pressure would inevitably collapse the flexible lead (as actually happened with two charges of 350 lbs. sunk on the wreck of the "William"), and the object of the latter would, therefore, be defeated, whereas by using the lead as a skin to the wooden case, no such thing could occur. Each cylinder was 6 feet long and 3 feet in diameter, internal

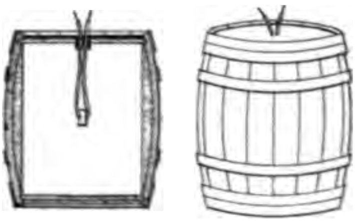
Section of Wooden Case to hold 2,500 lbs of powde
as used to destroy the "Royal George".

Section of Iron Case to contain 90 lbs of Guncotton.





Section and Elevation of charge of 60 lbs of Guncotton, used to destroy the "Trales"



Contrivances for making
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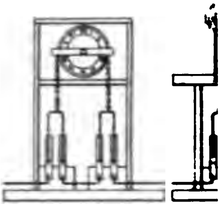

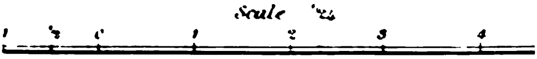

measurement; the thickness of the sides was 4 in., and of the ends 5 in., and the whole was bound together with four iron hoops. To protect the leaden skin from accident, wooden battens were fixed on the outside, canvas bags being used to fill up the intervals, and lastly the entire cylinder was wound round with a woolding of unserviceable rope. The leaden tube to contain the bursting charge was introduced from one end instead of from the side, and was 3 feet long, reaching to the centre of the charge, the loading hole being at the opposite end.

When these were completed, forty 5-gallon tin oil-bottles, capable of holding 45 lbs. each, were procured from the Tower, and were stowed along with the great cylinders, and the necessary stores, tools, and apparatus in a Navy lighter. Captain Williams, R.E., with a detachment of Royal Sappers and Miners, embarked in the same vessel, and set sail for Portsmouth on the 17th August, 1839.

While these preparations were going on at Chatham, arrangements were being made at Spithead for the commencement of active operations. A large dockyard mooring lighter was anchored on each side of the wreck, their distance apart being about 600 feet, and a number of careful soundings were taken, proving that the highest part of the wreck stood 33 feet above the ground, the depth of water at low water spring tides being 80 feet. Divers were also employed to examine and report upon the condition of the ship.

Armed with this information, Colonel Pasley proposed to fire his four great charges against the two sides of the wreck in pairs, not exactly opposite one another, but chequerwise making the interval between the charges on the same side 60 feet, the idea even crossed his mind of firing the whole four simultaneously; but this he luckily abandoned, and there is little doubt that had he attempted to do so, his electrical arrangements alone would have proved unequal to the task. He therefore determined to commence on the north side with two charges, and to reserve the others until their effect had been ascertained. The principle of hauling down, for placing the charges in position, had already proved successful; chain sweeps, with single sheave blocks, attached at proper intervals, were therefore sunk, and with some difficulty secured round the hull, while, in the mean time, the loading of the cylinders progressed. The several downhauls became entangled soon afterwards, and on the day fixed for the first explosion, only one could be got to work. A third lighter, with the charge on board, was warped into position between the other two, and the cylinder having been attached to one end of the only available downhaul, the unwieldly mass was drawn into its place, and there secured; the vessel containing the battery then moved off, paying out the conducting cables to nearly their full extent of 500 feet. When all was ready, the word was given to fire; but on completing the circuit nothing took place, and it was evident to all that the mine had failed.

A curious fatality appears to attend submarine demolitions, and was especially remarkable in the constancy with which it followed Sir Charles Pasley. Great as was his experience, his most important explosions almost always failed at the first attempt, though attributable to perfectly preventible causes. This was especially annoying, as crowds of spectators invariably assembled, among whom were generally the local Naval and Military authorities, and occasionally a Lord of the Admiralty, or some equally distinguished visitor. It seems strange that such people should congregate to see a splash, for the whole spectacle consists of nothing more, and in a judiciously executed demolition, as I have already shown, even this should not be seen.

As soon as possible after this failure, divers were sent down to recover the great cylinder, but for several days their utmost endeavours to liberate it were unavailing, and it was not until it had been under water for a week that it could be got to the surface. It was then discovered that the cause of non-ignition was a defect in the bursting charge, which proved to be wet, and the bad insulation of the wires, a matter of secondary importance with this form of fuze. But the most serious part of the misfortune was, that the water had forced its way into the body of the cylinder, and the whole ton of powder was spoiled.

In the course of the week, several small charges were fired in the oil bottles, for the purpose of testing their resistance to the pressure. Bickford's fuze was used for some, and the battery for others, and they all went off satisfactorily. Bickford's fuze was applied in short lengths of 4 or 5 feet, and lighted at the surface, after which the charge, with the fuze burning, was sunk with a sand bag. Experiments were tried to ascertain whether oil casks were strong enough to be used as cases, but they were invariably stove in by the pressure of the water after a few hours' submersion; means were therefore adopted to strengthen their heads, when they were found to answer well, and were largely used at a subsequent period. A variety of other cases, of different materials, were subjected to the same test, several forms meeting with approval; of these, the best was the service Nun buoy, which held 120 lbs. of powder.

On the 4th September, five days after the recovery of the cylinder, another attempt was made, which also failed, and again the charge was found to be partially drowned. Very severe comments were at the time passed upon Colonel Pasley when the news became known, and it was considered that he had undertaken more than he had power to perform. Still his confidence in his own ability did not desert him, and he left orders that none but small charges should be expended until the great cylinders had been severely tested. The plan now pursued was for the divers to sling any loose fragments they could come across, using small charges to dislodge portions which could not be moved by the machinery in the lighters above. On one occasion only did any portion of the wreck float, for the timber was heavy and waterlogged with years of immersion, and required powerful purchases to raise it. Now and then a medium-sized charge of 250 lbs., in a wrought-iron case, was fired, and by these great execution was done, so much so, that twenty such cases were ordered to be made, and were expended in the course of the work.

On the 23rd September preparations were once more made to fire one of the monster charges; the same method was adopted as before, and this time with success, a grand explosion taking place. Of course the attendance of spectators was not so great as on the occasions of the two failures, for people were weary of disappointment; those who were present were, however, highly gratified, and it is related that when the fragments of the wooden cylinder floated to the surface, a scramble to secure them ensued, and they were carried off as relics of the "Royal George."

The result of the explosion was to create a wide breach in the wreck, and a crater in the mud outside, about 8 feet in depth, enabling the divers to sling a number of beams and other fragments, besides several guns; and from long practice they became so expert, that the work was little more than a mere matter of routine.

The wooden cylinders having turned out badly, a large case was ordered to be made of sheet-iron, in a fashion similar to the medium-sized cases which answered so well, its shape was cylindrical, with conical ends, the total length being 8 feet. A charge of 2,300 lbs. was fired in this case under the ship's bow, then the most perfect part, on the 14th October, after a failure of the same charge a few days before, when, however, the powder escaped uninjured. A great mass of wreck was loosened by the explosion, and recovered by the divers, a few small charges being occasionally expended to hasten the removal of obstinate fragments. The party continued working till the end of the month, when from the setting in of bad weather, the operations were suspended, and postponed till the commencement of the following season.

It is unnecessary to follow further the history of this arduous and tedious undertaking. The same system continued to be pursued throughout the warm seasons of 1840 and 1841, that had met with such excellent results in 1839, and it was not until three years had been spent, that the last pieces were removed, and the roadstead was finally cleared of the obstruction, with which it had been so long encumbered.

Probably no demolition has ever been so completely effected as that of the "Royal George." It seldom occurs that a ship is wrecked at an anchorage, and it is only in such a situation, or in the midst of an important fishery, that it becomes a matter of necessity to remove the pieces at all, as the act of breaking up and dispersion produced by the judicious use of certain charges, is, generally speaking, enough to satisfy the demands of navigation, especially in places which are subject to strong currents or tides, the levelling effect of which on rough surfaces soon makes itself apparent. Care must, however, be taken not to rely too confidently on the force of a current; a ship contains too much solid and heavy material to be so easily disposed of, and though most reports of these operations wind up with some such assertion as that "nothing now remains but a few insignificant fragments, which the next spring tide will wash away;" such conjectures should be received with caution.

The great charges of powder made use of, though much more suitable on this occasion than in the shallower water of the Thames, might still have been reduced considerably with advantage, but nothing could have been better than the way in which the medium-sized and small charges were applied, and no fault can be found with the arrangements made for securing and weighing the detached fragments.

With regard to the diving operations, it appears that the use of the bell was soon abandoned, and the work left to the helmet-divers, whose freedom of action was comparatively unimpeded. The perfection which has now been reached in the manufacture of diving apparatus, has rendered the use of the bell obsolete, except for such purposes as laying foundations, and even here its advantages are doubtful, and its drawbacks great.

Simultaneously with the blowing up of the "Royal George," a similar operation, on a much smaller scale, was going on in India. The barque "Equitable," 420 tons burden, with a cargo of wheat and rum, was wrecked in the Fultah reach of the Hoogly on the 4th October, 1839, having grounded upon a newly-formed sand-bank in the middle of the river. She was thrown on her beam-ends by the current, and foundered. The depth of water over the wreck varied from 15 feet to 30 feet, according to the state of the tide.

Attempts to break her up proving abortive, it was ultimately settled to blow her up with gunpowder. The plan of operations decided upon was to lodge against the vessel a large charge of powder, and to ignite it by means of a powder-hose in a leaden tube in the manner first suggested, and put into practice by Sir Charles Pasley.

The cylinder to enclose the charge was made to contain 2,400 lbs. of powder, and was constructed of wood like a cask, and bound round with bands of iron; it was also enclosed in sheet lead carefully soldered at the joints. It was loaded through a small hole at one end, which was afterwards closed by a piece of lead, soldered over it. The leaden pipe was introduced into the cylinder through a water-tight joint of brass, and various minor precautions were taken to render the charge secure.

On the morning of 6th December, 1839, an anchor-boat with the large cylinder slung under her bows, was moored over the wreck in such a position that the charge, when lowered, would rest against or be close to the deck, and between the fore and main masts. As soon as the charge had been lowered, the anchor-boat slipped her moorings and the port-fire was lighted, but failed to fire the hose; a second port-fire did better, and the hose began to burn well; unfortunately, the quantity of powder in it was too great for the strength of the leaden pipe, the latter burst, water poured into the cylinder, and the charge was drowned.

After this accident, it was determined to employ the Voltaic battery, instead of powder-hose, as the firing agent.

As I have already mentioned, one of the principal drawbacks to the use of the platinum-wire-fuze is the necessity of having short conductors, unless the battery is very strong. In the present case, so bad was the form of battery used, that ignition could only be ensured at a distance of a few feet. To get over this difficulty, a small boat, containing the Voltaic battery, was moored immediately over the cylinder, and the wires from the fuze were led into her, so that the length of the wires being little more than the actual depth of the water, was reduced to a minimum.

A piece of mechanism was attached to an ordinary clock, which could be arranged to complete the battery circuit after the lapse of any required interval of time, and having continued the contact for a period amply sufficient to heat the platinum-wire in the charge, to break it again, and so disconnect the fuze from the battery. In this manner the clock could be started, allowing time for the operators to get away; it would be known when to expect the explosion, and, in case the charge failed to go off, it could be examined with safety, when the interval necessary for breaking the circuit had elapsed. However, the latter part of the performance never took place, for the charge exploded, and it is needless to say that boat, battery, and clock shared a watery grave. The result appears to have been considered satisfactory; an examination of the wreck showed that nothing but the fore-part remained, and this it was resolved to break up by another explosion.

A second cylinder, similar to this first, was prepared, and loaded with 2,050 lbs. of powder; the other arrangements were precisely as before. From some unexplained reason, however, the charge did not explode; in all probability there was a metallic contact between the conducting wires short of the fuze, enabling the current to return to the battery without passing through the platinum-wire. The cylinder was raised, and the powder found to be dry; new conductors were therefore applied, and the charge once more lodged in position. This time it was endeavoured to save the boat containing the apparatus by stationing her as far as possible from the charge, consistent with the probability of firing the fuze, and another device instead of the clock, for completing and breaking the circuit, was adopted, which is worth mentioning from its ingenuity. Two portfires of different lengths, calculated to burn respectively for five and eight minutes, were inserted into a piece of wood. A metal fork was suspended from the bottom of the shorter portfire by a piece of string, in such a way that when reached by the fire, it should be burnt through, allowing the two branches of the fork to drop into two cups of mercury placed below, completing the circuit between them. A weight was hung from the bottom of the longer portfire in a similar manner, which by its fall would raise the fork out of the cups, and so break the circuit.

This charge exploded, and appears to have completed the demolition, as soundings, taken immediately afterwards, proved the channel to be free from obstruction. The expense of these operations amounted to £261 12*s*. 6*d*.

This demolition may be characterized as an employment of brute force unskilfully applied. The author of the design was evidently servilely following Sir Charles Pasley, without considering the necessities and circumstances of the case, or adopting many of his useful precautions, and by using charges of a ton weight in water so shallow as 30 feet, the waste of power must have been preposterous.

Colonel Crawley, R.E., has furnished an account of the destruction by him of the brig "Blemdel." This vessel was of 160 tons burden.

laden with slates, glass, and coal. She sank in the Mersey, in 1846, in 70 feet of water, and became so serious an obstruction to the anchorage that it was found necessary to remove her.

A diver was employed to examine the wreck; he found her partially imbedded in the sand, a deep gulley having been washed on the starboard side by the tide, extending down to the keel. An eyebolt was screwed into the ship's bottom by the diver as near the keel as he could reach, and a single block hooked into the eyebolt, a rope had previously been led through the block, and by means of this the charge was hauled down into its place from the surface. The first cylinder contained 300 lbs. of powder; it was arranged to be fired with a platinum wire-fuze; the conductors leading to the fuze were as usual carried into a small tube of lead fixed into the cylinder, and containing a bursting charge of ½ lb. of powder.

The first attempt to fire the charge was unsuccessful, the bursting charge having got wet, the powder in the cylinder remaining dry. Greater care was taken the second time, and the charge exploded, demolishing the fore part of the ship. A second charge of 400 lbs. was afterwards lodged in the after-hold, some of the cargo being removed to form its bed. After it had been fired, the obstacle was reported to be removed.

A great portion of it must have sunk in the mud, otherwise the quantity of powder would have been quite insufficient. The power was, however, applied economically, and the charges must have done as much work as could be got out of that amount of powder.

The most extensive operations of this nature that have yet been carried out, were the demolitions of the ships sunk in the Hoogly, in the vicinity of Calcutta, during the great cyclone of the 5th October, 1864. Lieutenant Wallace, R.E., was the Officer employed, and it appears, from his report, that no less than fourteen large ships, several of which exceeded 1,000 tons burden, were blown up by him in the course of 1864 and 1865. His large experience is of great value, and his report, printed in the professional papers of the Royal Engineers, gives the fullest details of the plan of operations pursued. It was briefly as follows:—Having ascertained the position of the wreck to be operated upon, its position was accurately marked by buoys attached to the bow and stern, and other important points, such as the hatchways and masts. This service was performed by the native divers. Several moorings were then laid out in convenient positions round the wreck, and about 50 yards from it; the use of these was to warp the boats into any position required for lowering charges. The method of lodging these depended upon circumstances. When the vessel lay on an even keel, it was generally contrived to place them inside, by sliding them down bamboos introduced into the hatchways. Recourse was also had to this artifice to place the charges under the keel of a ship lying on her beam-ends up and down stream. In the case of a vessel sunk across the stream, the placing of the charges was effected by the current itself. The time selected was just before and just after low water, a charge being lodged on the upper side on the last of the ebb, and on the lower side by the first of the flood; the two charges

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credit of first bringing the material into practical
it in a compact and tolerably safe form, so much

principle to the well-known magnetic exploder of Professor Wheatstone, and consisting of a powerful permanent magnet, the current being generated by the rapid revolution of an armature between its poles. The conducting cable was a copper strand insulated with gutta-percha; it was found troublesome, from the melting of the gutta-percha by the sun.

The total number of charges used to destroy the fourteen ships was 160, containing an aggregate of 52,420 lbs. of gunpowder; of these, 21, containing 7,010 lbs., were drowned, the loss thus amounting to a little more than 13 per cent.

There can be no doubt that less powder would have been used had professional divers been available, so that the charges might have been placed in situations where their destructive effect would be most felt. As it was, the only divers procurable were the natives, who could not stay under water for much more than a minute at a time.

Our latest experience has been gained in the blowing up of the iron steamer "Foyle," in May, 1868, and the wooden schooner "Iredes," in November of the same year.

The former was a vessel of about 700 tons burden, and was sunk in the Thames, at Barking, and near the Essex shore. She had been down for about two years, during which time efforts had been made to lift her, but without success. She lay on an even keel obliquely across the stream, at low water the deck of the fore part dried, and at high water there was a depth of 40 feet all round her. Having lodged on a hard bank, her back was broken, and both bow and stern were sunk considerably below the level of the centre part, which rested on the ridge, the stern, however, being the lower of the two. An examination made by divers showed that the hull was otherwise perfect, with the exception of the loss of part of the deck, and a few trifling injuries produced by the explosion of some very small charges of powder, and that it was not at all imbedded in the bottom, the nature of which was hard peat. The reason of this was, that the tide, which here runs with great strength, had washed a gully all round her, throwing up a bank on either side.

To effect destruction, it was decided to use six large charges of 300 lbs. of powder each, and as many small ones of 100 lbs. as would be required to complete the demolition. 300 lbs. was selected as a quantity well suited for a depth of 40 feet of water; and in order to develop the full force of the powder, each charge was enclosed in a case of ½" boiler plate iron, rivetted, and fired by two fuzes at different points. By thus providing two centres of ignition, and a case capable of resisting a considerable internal pressure, it was ensured that the maximum amount of work of which the charges were capable would be secured. As an additional precaution against drowning, the actual powder was put into a strong bag of vulcanized india-rubber, and sealed up hermetically; the bag was then dropped into the iron case, and the top of the latter fixed on with bolts and nuts, also rendered watertight by a washer of india-rubber.

The result of these precautions was, that none of the powder was damaged by water; for though, in one instance, an iron case did let e water in after an immersion of twenty-four hours, the india-rubber g saved the charge, which went off as well as the others.

Spectators came at different times, but were much disappointed, on e occasion from a failure of the attachments of a charge, whereby got out of place, so that firing it would have been waste; and on hers, from not seeing the expected column of water; or, as was nticipated by some, portions of engines, boilers, iron plates, and inerior fittings, thrown high up into the air. The actual effect of an xplosion was simply a shock, and a slight heave of the water immeiately over the charge, amounting, perhaps, to 3 feet in vertical eight, succeeded by the rise of such fragments as were light enough o float.

On one occasion, a pair of 300 lbs. charges were exploded simulaneously; they were situated opposite one another, and abaft the ngines. The result was good; on both sides of the ship the plates were torn and broken for a considerable distance from the position of the charge, and it turned out that, by their united action, the whole after-part of the ship had been lifted bodily, and let drop again.

In all cases, the charges were secured to chains, which had been originally passed under the ship's bottom for the purpose of lifting her. A small rope was led by the diver through the lowest link of the chain which he could reach, and this, when brought to the surface, served as a downhaul, by which the charge could be placed in position, and then lashed. The cases were cylindrical, 2 feet in diameter, and 3 feet high, and weighed, when full, 6 cwt. each.

Just at the time that this demolition was going on, Professor Abel, chemist to the War Department, had brought to a conclusion his labours and investigations relating to the preparation and properties of gun-cotton, and had at length produced it in the compact form in which we now use it. Mr. Brown, of the Chemical Department at the Royal Arsenal, had also just made the wonderful discovery of the force exerted by this substance when fired by detonation. To make these points clear, I must digress in order to review very briefly the history of this remarkable explosive compound. It was discovered in 1846 by Schönbein, and experiments on a considerable scale were conducted to ascertain whether it could be advantageously employed as a substitute for gunpowder. Compared with the latter, it certainly seemed preferable for use in small arms and ordnance, as well as for mining purposes, from its freedom from smoke and solid residue, and from the great amount of force which could by its means be concentrated into a small space. A Committee was appointed in Germany to report upon it, which, at the close of its investigations, pronounced against it, and for the time it was abandoned. The manufacture was soon afterwards taken up by Messrs. Hall, the gunpowder manufacturers of Faversham; but a terrible explosion, by which many lives were lost, discouraged them to such an extent, that they also gave it up. Simultaneously, the French started two manufactories, both of which met with a similar fate. All this happened twenty years ago. To Baron von Lenk, of the Austrian service, is due the credit of first bringing the material into practical use, by producing it in a compact and tolerably safe form, so much so that it was introduced, and largely used, in the Artillery and Engineer services in that country. Still, as late as 1862 a disastrous explosion occurred near Vienna, proving that gun-cotton was not yet completely mastered.

It is hardly necessary to say anything with reference to the manufacture of gun-cotton, except that on the manner in which the various processes are carried out, and the care exercised at all stages, depends the stability of the resulting explosive, and consequently its security from spontaneous combustion, and safety when stored. By the action of concentrated nitric acid upon pure cellulose, a certain number of atoms of hydrogen in the latter are replaced by a corresponding number of atoms of peroxide of nitrogen, the number so exchanged depending on the strength of the acid employed. The highest of the substitution products so formed is that known to chemists as trinitrocellulose, and this is pure gun-cotton, as now manufactured. The lower substitution products are all found to decompose after a certain length of time, when exposed to peculiar conditions, and it was to this cause that the explosions which were so severely felt in the infancy of gun-cotton, owed their origin.

Baron von Lenk discovered that the nature of the explosion of gun-cotton could be regulated by the form in which the material was made up, and that when loosely disposed, it exploded with less violence than when compressed into a small space. He therefore brought it out in the form of yarn, and afterwards of plaited or twisted rope, which for a cartridge for artillery purposes was wound round a hollow wooden core, occupying a considerable space, so as not to injure the gun by too rapid ignition. For mining or blasting, on the contrary, the yarn was rammed tight, and strongly enclosed, the effect of which was to develop the force in its most destructive shape. At this stage of its progress the improvement of gun-cotton was taken up by Mr. Abel, who experimented largely with it in all the forms which were at that time known, and thoroughly mastered the theory of its combustion and the numerous attendant phenomena for which it is renowned. Among other points, he discovered that it was susceptible of two totally distinct kinds of combustion, the one rapid, producing explosion when confined, and the other so slow as to resemble smouldering. A lecture delivered by him at the Royal Institution in 1864, and printed in the proceedings of that body, contains a description of his experiments and the conclusions drawn therefrom, and possesses the highest interest. By these investigations Mr. Abel was led to improve upon the old-fashioned yarn, which I may remark was used by the Austrians in torpedoes for the defence of Venice in the last war, by reducing the gun-cotton when wet to a state of pulp similar to that used in the manufacture of paper, and afterwards forming it into discs or cakes under a pressure of from 4 to 5 tons to the square inch. These cakes, when dry, constitute the substance as now used. By the act of compression its specific gravity becomes nearly equal to that of powder, enabling a given weight of charge to be contained in one quarter of the space that would be required for an equal weight of any of the varieties of looser texture. Still it had this disadvantage. To explode it, it was necessary to confine it in an envelope of great strength, for when ignited in the open air it simply burnt like an ordinary inflammable substance, and until Mr. Brown applied the detonating explosion of fulminates as the means of ignition this drawback was greatly felt. Now, fuzes are issued precisely like those originally brought out by Mr. Abel for use with electricity of high tension, but primed with fulminate of mercury instead of powder, and these are always used to fire charges of gun-cotton, which, when so ignited, explodes even if perfectly open to the air, with as much violence as if confined in the strongest case. It has been remarked that the action of gun-cotton is sympathetic, for when lighted with a spark it smoulders, with a flame it burns, and with a detonator it explodes violently.

We have lately had many instances of the detonation. Being tried for the purpose of blowing in stockades, it was found that solid timbers of oak or fir, 13 inches square and strongly backed, could be cut through without fail by the explosion of 7½ lbs., simply piled loosely against them on the ground level. The action appears to be purely local, and the effect almost resembles a horizontal cut, so small is the damage produced both above and below the position of the charge. There can be no doubt that advantage might be taken of this action for cutting down trees, if it was required to fell a large number in a short time. But still more marked are the effects of detonation under water. A charge of gun-cotton, weighing 3½ lbs., fired at a depth of 7′ 6″, in that way gave a very perceptible shock to Her Majesty's ship "Hercules," at a distance of 400 yards, and such a quantity will kill and bring to the surface every fish within 100 yards. Neither of these effects have been experienced even with 20 or 30 times the quantity of powder. I do not mean to say that it represents an equivalent to such a proportion, but that the effects of the two are very different in character. The equivalent usually calculated on, is 1 of cotton to 4 of powder, weight for weight, when used for submarine purposes; and that it is fully up to this we have ample proof.

To return to the "Foyle." It was thought a pity to let so good an opportunity slip of testing practically the value of this terrible explosive. The last of the six cylinders was therefore filled with cotton, 260 lbs. being the quantity. The fuze employed was a common powder fuze, but the gun-cotton acted explosively, on account of the great strength of the iron case in which it was enclosed. The charge was lodged opposite the engines, the strongest part of the ship, in a spot where one of the 300 lbs. powder charges had been previously fired without producing any result at all. The effect of the explosion was remarkable. The shock was most violent, and very different in its suddenness from the comparatively slow heaving force of gunpowder. The engines were completely broken up, and a breach made in the ship which the divers were unable to examine, owing to the tangled mass of twisted and broken iron bars and plates which lay in a confused jumble at the bottom, for it must be borne in mind that the wreck lay nearly opposite the great sewage outfall, and the water was in consequence so filthy that a diver at the bottom worked in absolute darkness. Indeed, on a previous occasion he was in a serious predicament, for groping along where a charge had been fired, his life-line was caught in the jaws of a torn plate, and being unable to free it, he came up hand over hand on the air tube.

The experiment was conclusive as regards the expediency of using gun-cotton for submarine explosions. There is little more to relate with reference to the "Foyle." After the explosion of the great charges, five smaller ones of 100 lbs. each, in tins were sunk in various places. One was drowned from a failure of the tin, and the others exploded. They were used wherever it appeared that portions of the wreck were hanging together, and their effect was excellent. It was difficult to determine the exact condition of the wreck at the close of the operations, from the impossibility of employing divers: preparations were however made to raise the detached fragments by the agency of a powerful steam dredger, which I believe to be at work still. The time occupied in the actual blowing up was two months, including a long delay while the iron cases were being made. The expenditure of explosives was—

Gunpowder	2,000 lbs.
Gun-cotton	260 lbs.

The working party consisted of one serjeant, one corporal, and five men of the Royal Engineers. I was in charge, and had the immediate superintendence of the work, acting under instructions from the School of Telegraphy and Submarine Mining at Chatham. A professional diver, lent by the Naval Authorities of Chatham Dockyard, was employed; the serjeant of my party also dived, and soon became expert, and we all went down at different times for practice. The corporal was employed as electrician and had charge of all the arrangements connected with the loading and firing of the charges. The battery used was Baron von Ebner's frictional machine, and the conducting cable a 7-strand copper wire, insulated with coatings of vulcanized india-rubber and other substances, and known as Hooper's core.

The results of the large charge of gun-cotton fired against the "Foyle," and of comparative experiments subsequently carried on in the Medway, were so satisfactory, that when, in October, 1868, a request came from the Trinity Board that the wreck of the schooner "Iredes" might be blown up, it was thought advisable to use it exclusively, in preference to powder.

It had been conclusively determined, that for the purpose of submarine mining, the value of gun-cotton was not less than four times that of powder, while its cost was three times as much, weight for weight; consequently its employment entailed an absolute saving in the cost of the explosive agent of 25 per cent. When, in addition to this, it is remembered that a charge of gun-cotton occupies one-third the bulk of a charge of powder, capable of doing the same amount of work, that when fired by detonation it does not require a strong case, but simply a water-tight envelope, and that in the event of its getting wet, it sustains no permanent injury, but is as good as ever when again lried, it will be clear, that the advantages attendant upon its employment are very great.

Four charges to be used against the "Iredes," were prepared as 'ollows:—Cylindrical tins were made, 19 inches long and 15 inches in liameter, just to fit inside 12-gallon casks. Each tin, after being filled with 60 lbs. of gun-cotton, and provided with a detonating fuze, was soldered up. This operation had to be performed with care, as guncotton explodes at a very low temperature. The two wires from the fuze passed out through a nozzle of tin secured to the top of the cylinder, in which they were hermetically fastened by a bung and a quantity of pitch poured in hot and allowed to cool. The tin was then dropped into its barrel, and rammed all round with sand, to give it steadiness and weight, and, lastly, the barrel was headed up, the tin nozzle passing through a hole in the top, and all cracks and apertures were filled up with hot pitch.

The wreck was on the Cant sand, three miles below the Nore; she was a small wooden vessel, laden with slate. The work of examination by divers, and placing of charges, was performed by men from the Engineer barracks at Chatham, who went down each day in a naval steam launch. The time of year, being winter, was very unfavourable, especially as the wreck was more than three miles from the nearest land, and the work was all carried on from an open boat, and was, moreover, 25 miles from the base of operations.

From these causes great trouble and delay ensued, for it was impossible to work in rough weather, and valuable time was lost in coming and going, which could ill be spared from short November days. However, by the end of the month the four charges had been expended, three on the starboard side at equal intervals, and the fourth near the bow on the port side. Gales set in at the beginning of December, which rendered it necessary to abandon the work, and it was resolved to delay its completion till the commencement of fine weather in the ensuing spring.

On the 3rd April last we were able to proceed to the spot, and an examination, lasting three hours, proved the wreck to be completely broken up, the *débris* being scattered over the sand. As far as navigation is concerned, therefore, the obstruction has been practically removed by the expenditure of 240 lbs. of gun-cotton; but for the sake of the fishery it has been decided to weigh these fragments, for which purpose a lighter with suitable gear will be provided.

Although gunpowder and gun-cotton are the only explosives which have as yet been applied to the demolition of submarine obstructions, there are various others which might be used for this purpose. The chief of these are nitroglycerine, glyoxyline, and dynamite. The first of these has the pecular advantage that its explosive power is not impaired by the entrance of water, so that a small leak in the enveloping case would not of necessity cause a charge to fail.

On the other hand, it possesses serious drawbacks, such as a tendency to explode spontaneously when stored, and to congeal at a very moderately low temperature, in which state it is liable to go off with a blow.

Glyoxyline is gun-cotton soaked in nitroglycerine, of which liquid it will absorb its own weight. It is subject to many of the disadvantages of nitroglycerine, and, like it, is very poisonous to handle. Its effects, when fired with a detonating fuze, are very similar to those of gun-cotton, but rather more powerful.

Dynamite is a mechanical mixture of nitroglycerine and sand, and was introduced for the purpose of obtaining the force of the former in a solid state. It presents no advantages over gun-cotton, and is open to the same objections as the other explosives of this family. It has been used with success in Sweden, for torpedoes exploded in contact with a ship's bottom. All these materials are unpleasant to deal with, their questionable advantages are more than counterbalanced by the risk attending their employment, and the uncertainty of their action. Picrate of potash has lately been used by the French for torpedoes, but the recent fearful explosion in Paris shows that it cannot always be trusted. Of this substance we have no practical experience. On the whole, gun-cotton satisfies all our requirements, when we desire anything more powerful than powder, and its safety and tractability render it peculiarly valuable for employment in rough descriptions of work, where the utmost precautions cannot always be taken. Other compounds may be found to give good results in the laboratory, where every refinement of apparatus and manipulation is available; but it may be broadly laid down that in an explosive for practical purposes, the essentials are simplicity, safety, and trustworthiness.

To sum up the substance given in these pages, we see the application of explosive compounds to the purposes of submarine mining, advancing step by step, from rude appliances and wild conjectures, to scientific machinery, and rules based upon the laws of nature. We see the monster charges, at first considered essential, fired with their clumsy powder-hose, or bits of hot metal dropped down a tube, gradually giving way to more rational quantities, and Volta's pile introduced as the igniting agent. Then, with the progress of electrical science, the discovery of the conducting power of water, enabling one wire to be used instead of two. Next the employment of electricity of high tension, generated by a small portable instrument, superseding the objectionable battery with its poisonous acids and fragile cells; and, lastly, we see the detonating fuze developing the gigantic power of the hitherto unmanageable and eccentric gun-cotton.

On the general points to be attended to in conducting operations of this description, our present experience may be stated as follows:—

The first thing to be done is invariably to make a thorough examination of the nature and state of the obstruction.

Where great resistance is anticipated, gun-cotton will prove especially serviceable, and generally so in most cases, except perhaps of a ship much shaken, or weak in construction, which would be better destroyed by gunpowder in small charges.

The charges should be regulated according to the depth. A safe rule to follow is to use $\frac{1}{4}$ of the square of the depth in feet for the charge in pounds. This applies to gunpowder; for example, at a depth of 30 feet, use 225 lbs. For gun-cotton, $\frac{1}{4}$ of the weight so found is sufficient.

Charges should be placed inside a ship, unless the operation is likely to be attended with risk to the divers, or she is much filled with cargo or mud, because ships are built to resist pressure from the outside, and yield readily to a force from within.

To calculate the quantity of powder required to destroy a wreck, allow 20 lbs. per foot length of the vessel; thus, for a ship 100 feet long allow 2,000 lbs.; this is more than enough in most cases.

Under favourable circumstances, and where military labour is available, the cost may be roughly estimated at £1 per foot; that is £100 for a ship 100 feet long. This is only the cost of blowing up, not of removal.

A wooden ship requires as much explosive material as an iron one, but the subsequent removal is less expensive.

Demolitions should not, unless it is imperatively necessary, be undertaken in winter, when short days and bad weather involve loss of time and delay, and workmen are subjected to hardship and exposure.

The base of operations should be on the spot, so that the men can be ready to work at all times, according to the state of the tide; a commodious vessel to house the working party should be provided, also a lighter with gear for lifting heavy weights, and a large boat for the divers.

Casks can be used for cases up to a depth of three fathoms, after which they require strengthening, or, what is preferable, iron cases should be substituted. A double protection to the charge should invariably be provided, the second being either of tin, india-rubber, or water-proof canvas.

Simultaneous explosions of several charges should not be attempted, unless the electric cable is very good, and there is no chance of its getting broken or injured between the various charges. If these conditions can be ensured, they can be used with great effect.

A charge should not be fired while any portion of the wreck in its vicinity remains out of water, as fragments are liable to fly to great distances, but a very slight covering of water is sufficient to prevent this taking place.

In concluding this paper I must observe with regret, that I have left unsaid many things in connection with the subject, which are both interesting and important, especially as regards the application of electricity to the explosion of charges; but I have found it a task of sufficient difficulty to condense information on the main points to be considered, into a reasonable compass, without touching upon collateral subjects. So many different studies are involved in this question, that I have several times found myself in the dilemma of either passing over some point unexplained, or wandering away from my subject to get at first principles. My endeavour has been, not to produce an entertaining essay, but to give as much practical information as possible in a small space, for which purpose the brief accounts of former demolitions, with their numerous failures, are instructive; and if I have to any extent succeeded in so doing, though at the expense of interest my object will have been gained.

Commander W. DAWSON, R.N.: I am sure Mr. Jekyll's paper has been most interesting. The only fault I have to find with him is, that he stuck so closely to his text. I hoped that he would have gone a little out of the way, and given us some of that great fund of information which they have at Chatham with reference to the laws which govern submarine explosions in general. I came into this room hoping that the authorities had removed the bar which has been put upon Officers of the two Services, getting the exact information which exists with reference to the very important subjects which Mr. Jekyll has brought before us, and upon some collateral points. For I need not say that the explosion of gunpowder and guncotton under water has reference not only to the peaceful subject to which he has called our attention, but also to very hostile purposes, for which there can be no doubt that in future wars it will prove a very powerful weapon. I am not going to deviate so far as to go into that particular subject, but I cannot let the occasion pass, without saying that in my humble opinion it is a great mistake for the Royal Engineers and the gunners of the "Excellent" to be employed in accumulating a large amount of important information on submarine explosions, and that that information should be stored up on the shelves of the War Office or Admiralty, and not be communicated to the Officers of the two Services. It is a very important point that we should have this exact information with reference to submarine explosions, otherwise Officers may be led away by the false statements published.

I mean to confine the remarks that I have to make to this one part of the subject that has been brought before us; because the subject is a very large one, and there are gentlemen in this room so thoroughly acquainted with the best modes of submarine ignition, and also with the explosive compounds which are to be enclosed in the cases, that it would be the height of presumption on my part to offer any remarks upon those two parts of the subject, upon which they will doubtless speak. The necessity of our having exact information is shown by the fact that the Officers of both Services are limited for their information to such garbled statements as come from foreign countries of experiments that are said to have been made there. And, unhappily, some of those garbled statements have got into the very best type, and on to the very best paper, and in the very best binding, which gives them an appearance of authority to which they have no right, and, consequently, some of my brother Officers who have not had the opportunity of studying this subject so much as others in the room, are liable to be led away into crediting the wildest statements in reference to the explosion of gunpowder under water. I allude now to a book which was published last year by Lieutenant-Colonel Von Scheliha, late a Confederate Officer, whom one might expect to give a correct statement of how the Confederate States endeavoured to blow up 25 of the Federal ships, and injure nine others; because, if we did possess exact information with reference to that, we should learn a great deal about submarine explosions. What are the statements which I find in Von Scheliha's book? In the first place, he gives us simply a reprint of the Federal despatches, and of some old pamphlets published in this country years ago. But in one chapter he gives us very exact details of submarine explosive experiments; so exact that one is tempted to believe that those experiments must really have been carried out by somebody, somewhere, and at some given time. But he does not tell us who carried out those experiments, when they were carried out, or where they were carried out. I find at page 282 of his book that: "A torpedo containing a "charge of 400 lbs. produced at a depth of 12 feet, and at a distance of two feet "from the vessel, no effect on the side of the vessel." Mr. Jekyll could tell us that that is an absurdity, that 400 lbs. of powder so immersed would be effective upon a substantial ship if afloat, at a horizontal distance of 14 or 15 feet. On the same page Von Scheliha tells us that, "a thousand pounds of powder enclosed in a strong wine cask produced, at a depth of 18 feet, and a distance of *four* feet from the vessel, hardly any effect whatever!!!" Now, we know very well that a thousand pounds of powder so immersed would be effective against a strong ship afloat at a horizontal distance of about 20 feet. Turning to another page of the book, I find he makes 150 lbs. of powder, exploded with 15 feet immersion, effective in breaking iron rods at a distance of 27½ feet. How he reconciles those two statements I do not know. Neither of them is correct. It would have been nearer the truth if he had stated that this 150 lbs. of powder would produce its principal destructive effect at 10 or 11 feet. At page 283, Von Scheliha further states that at a distance of *four* feet *below* the bottom of the vessel, 400 lbs. of powder produced a *doubtful* effect. I need hardly say that the explosion of such a charge so placed would send the bottom of the strongest ship right through all the decks into the air. Then comes a general statement, equally fallacious, at page 285, that the effect of torpedoes placed close to, or on the bottom of the channel, seems to spread more in a horizontal than in a vertical direction. Mr. Jekyll has shown us that the relation between the horizontal powers of an explosion and its vertical effect is dependent upon the depth of immersion and the amount of the charge; and that in order to prevent an excess of vertical effect, he found it necessary to use comparatively small charges proportioned to the depth of water. I merely mention this to show the advantage which we should obtain if other branches of the profession could only get at the exact information which the Royal Engineers possess.

There are two things to be considered in placing a submarine charge: first, its depth of immersion; secondly, its horizontal distance from the object. With reference to the work which Mr. Jekyll has in hand, of course, the question of distance does not come in, because the object being fixed on the ground, the charge can be placed in contact with it; therefore, the only question to be considered is, the depth of water. Moreover, the destruction of a wreck full of water or sand would necessitate the employment of a larger charge than the destruction of a ship afloat, the charge being similarly applied, so that it is difficult to reason from the conclusions arrived at on one subject, to that which ought to obtain on the other. I am afraid I should be travelling wide of the subject if I said anything further except upon the particular point to which Mr. Jekyll has confined himself so well. But I cannot sit down without expressing my admiration of the zeal, ability, and patience which have characterised the operations of the Royal Engineers in carrying out a most difficult investigation, and conducting a series of most painstaking experiments for the purpose of arriving at those very facts which Mr. Jekyll has communicated to us in a very few paragraphs. For years they have been engaged in submarine explosive operations, and it is hardly to the advantage of the other branches of the public service that the result of these experiments should be withheld from them. There is, however, one point I wish to speak to before I sit down. The explosive experiments which have been conducted by the Royal Engineers, important as they have been, and great as have been the truths they have brought out with reference to the laws which govern such explosions, have been made with comparatively small charges. Those experiments should be verified by much larger explosions. From time to time, opportunity should be taken, when vessels are being broken up, and on other similar occasions in which larger explosions might be made, of exploding different amounts of powder or gun-cotton, arranged at fixed distances, in order to ascertain whether the law which governs the effects of small charges, governs also the results of larger charges. I suppose when we apply these charges of powder for hostile purposes, we shall apply charges of a thousand pounds of powder, or the equivalent in gun-cotton, for stationary purposes, and when we employ them for locomotive purposes we should not recommend any charge less than 150 lbs. We should know exactly what the effect of that 150 lbs. will be upon our own vessel if we do not hold it at a safe distance, and also how near we ought to bring it to an enemy's vessel in order to destroy her. Upon those points we have already a vast amount of theory and some little practical information, but we want much more real experience with the actual weapon, in the complete form, in which it would be actually employed on service.

Lieutenant JEKYLL: With reference to the question of torpedoes, I have had quite enough to do to talk about the subject which I have in hand, the destruction of vessels under water, without touching upon torpedoes. It is a very large field; it is impossible to condense into the space of an hour any information respecting it. With reference to the present state of the subject that Captain Dawson has [illegible] speaking to, we have a great mass of experiments, and we have a still [illegible] of theory; but we have not a very large amount of practical information

And the authorities at present appear to take so little interest in the subject that it is not likely we shall get much more.

Commander Dawson: Might I ask one more question, with reference to the effective distance at which gun-cotton may be made use of, when exploded by detonating fuzes, if it is not a secret?

Lieutenant Jekyll: I can hardly answer that question off hand.

Commander Dawson: We now know pretty well the horizontal distance at which given charges of gunpowder or gun-cotton, exploded in the old way, will be effective when exploded against a ship. For instance, we know that 100 lbs. of gunpowder, or its equivalent in gun-cotton, if it is immersed to a depth of 10 or 15 feet, will be effective at a horizontal distance of 9 or 10 feet; we know that 1,000 lbs. of powder, if it be immersed at any depth below 10 fathoms, will be effective at a horizontal distance of 20 feet. The question I want now to put is with reference to this new mode of exploding gun-cotton by detonating fuzes, whether the horizontal distance at which the immersed charge will be effective is increased by the mode of ignition, and how much it is increased in relation to that of gunpowder?

Lieutenant Jekyll: As far as our experiments have gone at present, we are fully satisfied that a charge of gun-cutton, one-fourth the weight of a given charge of gunpowder, will produce equal results at the same distance; using the detonating fuse, of course, which is always used with charges of gun-cotton. But our experiments as yet have been so few that we have not determined the exact distance yet.

Commander Dawson: How do you reconcile that with the statement that an explosion of gun-cotton killed so many fish a long distance off?

Lieutenant Jekyll: That is from the peculiar nature of the explosion: probably from the shock being transmitted through the water.

The Chairman: If no other gentleman has any question to ask, I am sure this meeting will agree with me that we have had a highly interesting paper from Mr. Jekyll. I beg to return him, in the name of this meeting, our best thanks for his communication.

LECTURE.

Friday, June 4, 1869.

COLONEL PHILIP J. YORKE, F.R.S., Vice-President, in the Chair.

THE APPLICATION OF PHOTOGRAPHY TO MILITARY PURPOSES.

By H. BADEN PRITCHARD, of the General Photographic Establishment of the War Department.

THE applications of photography to warlike purposes in this country are numerous and various. At the Ordnance Survey Office, Southampton; the Engineer Establishment, Chatham; the Barrack Survey Department; at most of the Royal Engineer stations abroad; as likewise at the General Photographic Establishment of the War Department at home, the art is more or less employed in the prosecution of work undertaken by those establishments. In connexion with the production of surveys, the engraving of maps, the copying of designs, the registration of service patterns, the recording of experimental results, the instruction of troops, the controlling of work performed, and in other directions too numerous to mention, photography is extensively employed to do yeoman's service; the faithful accuracy with which the art fulfills its functions, causing its aid to be eagerly sought for in any way where it can be made available. Not only, however, does the employment of the camera recommend itself on the score of fidelity, ut likewise by reason of the very inexpensive nature of the results urnished, and the degree of facility with which they are obtained. rom the fact that they are invariably absolute copies of the originals, eproductions obtained by means of photography must always be ndowed with a certain value, while in many cases, where it would ave been impossible to have secured pictures by any other means, the sults of the camera are simply priceless.

The first time that photography was used in connection with military atters was during the Crimean war. Lord Panmure, then Secretary State for War, conceived the idea of securing some photographic cords of the campaign, which would afford reliable information on rious points; he accordingly consulted Mr. J. Mayall, the well-own London photographer, on the practicability of carrying out his oject, and requested that gentleman to undertake the instruction of two Officers detailed for duty as photographers. These Officers—Ensigns Brandon and Dawson—were accordingly instructed by Mr. Mayall in the wet and dry collodion processes, as likewise in the albumen process, a method which proved especially suitable for manipulating in hot weather. Their equipment was superintended by Captain Foulkes, and the results they obtained were on the whole very satisfactory, some of the large views taken, being especially interesting. The series of pictures produced, or at any rate a large proportion of them, are, I believe, still stored up at the War Office, although I have reason to fear they will be found to have faded considerably; for it must be borne in mind that at the time these photographs were produced (1855–56) the art was still in its infancy, and many of the manipulations pursued, were necessarily of an experimental or imperfect nature. Besides the Crimean pictures taken by these Officers, some very important views were secured by Messrs. Fenton and Robertson, many of whose results are still in a state of good preservation.

Since that period, the art-science has progressed to a wonderful degree, so much so, indeed, that we cannot but anticipate its speedy and complete perfection. In the same ratio as the process has improved, its applications have increased and become more wide-spread, and the necessity for a diffused acquaintance with the subject has been so fully appreciated by the Authorities of the War Department, that a school of instruction has been formed for the special purpose of imparting to classes of young soldiers a knowledge of the details and manipulations of the process. This school, which forms portion of the Royal Engineer Establishment at Chatham, and is now under the direction of Captain Stotherd, R.E., has during the period of its existence been of considerable benefit to the Service. During the recent Abyssinian campaign, a staff of photographers, instructed and equipped from this establishment, was attached to the Quartermaster-General's Department, and did good service in copying maps and sketches of the route, and in taking pictures of those objects and points of interest, of which a record was considered desirable. The operators were seven in number, Serjeant John Harrold, R.E., being the chief photographer of the party, and the results of their labours, conducted as the latter were, under circumstances of considerable difficulty, speak much for the ability and skill of the Non-Commissioned Officer in charge.

Passing from photography in the Field, to which I shall presently return, I come to the applications of the process made by the non-combatant portion of the Service. One of the most important uses to which the process is put, in the British War Department is, without doubt, as an aid in the copying of maps, plans, designs, rare M.S., &c., as practised at the Ordnance Survey Office, Southampton. In this establishment the process of photozincography, the invention of Colonel Sir H. James, R.E., has been carefully elaborated, and employed with such marked success, under the direction of that Officer, that the Governments of France, Austria, Belgium, Holland, and America have adopted the art, or some modification of it, for carrying on work of a similar nature. Indeed to so great an extent has the process been taken up, that Sir Henry James's establishment may be regarded, in many respects, as a model upon which the Foreign Military Survey Departments have been constructed. The principal work performed by means of photozincography at Southampton, is the production of special maps for warlike and other purposes, in those cases where rapidity of execution is necessary, and when the expense of tracing them by the ordinary engraving method cannot be incurred. Besides its application in this direction, Sir H. James's process has done valuable service in furnishing reproductions of unique M.S., such as the great and little Domesday Books, the national M.S. of England and Scotland, and other important works, all of which are necessarily reproduced with perfect truth and accuracy, and without the necessity for tampering in any way with the originals.

Photography is also used by the Ordnance Survey in obtaining pictures of objects of national importance; and at the present time the surveying party engaged in the Peninsular of Sinai have attached to them a photographer from Southampton, who, according to latest accounts, has secured more than 150 important views of the country. The Royal Engineers sent out to survey Jerusalem also brought home with them upwards of 100 views of interest.

At the General Photographic Establishment, a branch of the Chemical Department at Woolwich, under the direction of Professor Abel, F.R.S., the camera is employed in very many ways. All experimental structures, whether in the shape of shields, guns, small arms, waggons, slides, rockets, &c., are photographed, and pictures thereof recorded; the results of firing experimentally against iron plates of different thicknesses are reproduced and preserved; instructional pictures shewing the methods of working guns of different descriptions, and the positions taken up by individual gunners on the issue of the various orders, are taken; photographs exhibiting the regulation mode of wearing accoutrements, the precise manner in which the harness of horses is adjusted, the method of packing waggons, and fitting service-saddles, the mode in which military tents and equipage are set up, as well as the preparation of pictures of newly adopted stores and implements, are among the duties fulfilled at the department. Prints from the negatives thus obtained are issued to various branches of the Army, both in this country and in India, so that any information which it may be necessary to give to subordinate departments is by this means diffused in an intelligible and rapid manner throughout the whole of Her Majesty's dominions. The sizes of the pictures issued from Woolwich vary from 10″ × 8″ to 15″ × 12″, and the annual issue of prints fluctuates from 18,000 to 25,000.

While on the subject of photography at Woolwich, I would mention one direction, in which its aid might possibly be invoked to good purpose at that and other manufacturing stations; in respect, namely, to rendering unnecessary, in many instances, the construction and preservation of costly patterns. In the manufacture of certain articles of equipment, it is doubtless necessary that a perfect and carefully-finished specimen should be at hand, serving both to guide and control the work; but where munitions of war differ from each other only in size or in matters of detail, and where the nature of materials used in their construction need not actually be exhibited, lithographed plans, together with photographs taken to scale from various points of view, would afford ample information for their manufacture. Thus, of all articles of *matériel* adopted into the Service, one specimen of each type might be preserved as a pattern of a certain class, and this pattern, together with descriptive information and appropriate sketches, would suffice for the construction of all articles on the same principle, but of modified form. In the majority of cases, three photographs would be sufficient to accompany the lithograph drawings; they would be taken to scale, and in such a manner as to show detail, without distortion of the picture. To facilitate the operation of photographing in an instance of this kind, it would be advisable to colour roughly those portions of the object which it is desired more accurately to depict, or to attach to them descriptive labels to be reproduced by the camera. It is scarcely necessary to state, that the cost of producing pictures of this description would be very small, and, inasmuch as lithograph plans of all service articles are already in existence, the adoption of this method would be a measure of undoubted economy. Moreover, copies of these plans might be made at a trifling cost for deposition at the War Office and Horse Guards, by which means those departments would be kept well informed upon the subject of service patterns.

Modifications of Sir H. James's photozincography are likewise used at Woolwich, at Chatham, and, as previously stated, abroad, but as it is my intention on the present occasion to treat more especially of the employment of photography proper by the Army in the Field, I will defer my remarks in regard to the extent to which the art is employed in foreign War Departments, and proceed at once to describe in what way the camera has been, and may be, employed in connection with campaign service.

The avowed purpose for which photography has been hitherto used in the Field, is as a means of reducing and copying plans and maps; the taking of pictures of important localities and interesting objects, has occasionally occupied, it is true, a portion of the military photographer's labours, but the production of such results have been always considered as partaking of a private or semi-official character.

In the capacity of multiplier and printer of maps, the aid of the photographer is very welcome. During the progress of troops through strange lands, it is of the last importance that the Commander-in-Chief should possess a perfect knowledge of the country by which he is surrounded; not only is an acquaintance with the position of the roads, rivers, and mountain ranges, such as shown on ordinary maps, requisite, but information in respect to minor details, as for instance, the nature of the ground, the whereabouts of timber and hedgerows, paths, and other land marks, is likewise needed. To prepare plans of this description on a large scale, Staff Officers are detached on *reconnaissance* expeditions, and the information thus collected is at once committed to paper and forwarded to the Quartermaster-General's department. Here we may see at once the important use to which the camera may be put. The plans are necessarily drawn to scale, but it is by no means imperative that all sketches should be made of the same relative dimensions, for in reproducing them in the camera, the originals may be easily enlarged or reduced to any standard measurement. If a large issue of copies is required immediately, several negatives are at once taken, and these, consisting simply of opaque glass with transparent lines, are easily and rapidly printed. As an instance of the expedition with which work of this kind is conducted, I may mention that during the Abyssinian campaign, as many as thirty copies were sometimes prepared and distributed to brigadiers and others within four-and-twenty hours of the original plan being sketched. The maps are printed upon paper and mounted on linen, so as to render them stout and durable; but it will be a question for consideration whether it is not better to print direct upon the fabric. By saturating linen, cambric, or silk with albumen, or even simply impregnating it with a solution of salt, a very suitable material may be produced which can be folded up and packed away without risk of damage, and is yet sufficiently stiff for purposes of a field map. No difficulty would be experienced in preparing the fabric for photographic purposes, and in this state it may be manipulated with as much facility as paper. Moreover, by its adoption, the time-taking-operation of mounting would be dispensed with, and the prints being upon a more permeable material than paper, would require a less amount of washing, an operation of very great importance in photography.

I have said that the taking of landscape and other pictures by photographers in the Field has not been considered, up to the present time, as strictly within their official duties, and photographs of this description have, therefore, hitherto been very sparingly produced. This is much to be regretted, as it certainly seems unwise when the Staff has been provided with all the appliances ready at hand, that the same should not be employed, at the discretion of the Commander-in-Chief, in obtaining records of such objects as are likely to prove of value and interest. As an illustration that pictures of this kind are frequently of great worth, we may instance the series of views of Abyssinian scenery taken during the recent campaign, in respect to which the only fault to be found is, that there are so few of them. These photographs are at present of the utmost value, and those of Magdala, representing a stronghold as it has existed probably for centuries, and which exists no longer, are altogether irreplaceable. And yet these pictures would never have been obtained if the camera had been devoted exclusively to the purposes for which it was designed; we owe them entirely to General Napier or his Staff, who, on individual authority, gave orders for their preparation from time to time. In the same way a few mementoes were obtained of the Indian mutiny and Chinese war of 1860; but unfortunately in these cases, the pictures preserved of the campaigns are even fewer than those of Abyssinia.

Besides, however, the question of obtaining pictures of points of interest for subsequent preservation and record, landscape views taken judiciously, might be made to render considerable aid to an Army in the Field. In the first place, by employing a modification of the ordinary camera, it is possible to use the same as a surveying instrument and plane-table in the manner recommended by Captain Jouart, and adopted to some extent by the French War Department. Again, another mode of utilizing the lens would be as a reconnoitrer and judger of distance; by employing an instrument possessing a long focus (the body of the camera being in the form of a telescope so as to be capable of fitting into small compass), a very serviceable view might be taken of a fort, embrasure, or fortified locality, at a distance exceeding 1,500 yards, and out of range of small arms. A clearly-defined picture, produced in this manner, is capable of being enlarged to the extent of five or ten diameters, and thus a sketch of useful dimensions may be secured of an enemy's position without much risk of danger. It would merely be necessary in a case of this kind to obtain the picture in the first instance perfectly distinct and sharply in focus, the camera being directed at the object when the sun's rays impinge upon the latter at an angle of about 45° (the most suitable angle for landscape photography), so that all details are sufficiently illuminated. To demonstrate what may be done in this matter, and at what a distance it is possible to operate successfully, I may mention that I have been able to photograph a building situated two miles from the camera, and subsequently to obtain an enlarged picture thereof, which, had it been taken direct, would have necessitated the approach of the camera to within one-eighth of the above-named distance. The camera may, as I have said, also be used in this way as a theodolite, and the distance or range between the reconnoitring party and the enemy's position accurately and rapidly determined, supposing the actual dimensions of the enemy's fort or entrenchment to be known. Thus, if the object to be photographed is 50 yards long, and the image depicted upon the focussing-glass measures one inch in length, it is easy to calculate the exact distance which intervenes between the object and the camera, knowing as we do the focal length of our lens; if the latter amounts to 25 inches, it is clear that the object depicted in the camera is precisely 1,250 yards distant. In making these calculations, the image must always be sharply focussed and accurately measured by means of a glass rule, upon which a finely-divided scale is marked.

Another use to which the camera may be put in the Field is in the production of landscape pictures to illustrate the ground plans or sketches of routes circulated throughout the Army. One or more stereoscopic views, showing the undulations of the country, the nature and description of the land, whether of a cultivated or rugged character, whether wooded or agricultural, would greatly enhance the value of these plans, and would convey at once to Commanding Officers precise information respecting the country through which troops will have to march. If stereoscopic views were considered of too large a size, smaller pictures might be taken and subsequently enlarged; but in the case of single photographs only being appended to the maps, they should invariably be examined by means of a magnifying glass, as *relief* is thus imparted to the picture, and its details more faithfully portrayed and understood. The time and trouble involved in obtaining these pictures would be very trifling, and no especial knowledge in manipulating the process would be required for the purpose. An Officer attached to the reconnoitring party could easily carry the two packages necessary for the purpose, which might vary in size from three inches cube upwards, according to the dimensions of the view required. One of these packages would be the camera, and the other a couple of carriers, or plate-box, similar to that fitted to Edward's miniature apparatus. The camera might be provided with a lens, which should always be in focus, or, inasmuch as pictures would generally be taken at some considerable distance, an ordinary lens might be used, the focus of which has been adjusted to an object distant one hundred times the focal length of the instrument; for it has been found that a lens thus focussed, yields a tolerably clear definition of any objects beyond the distance mentioned. The camera, therefore, has merely to be set down in the direction in which the view is to be taken, a glance being all that is necessary to ascertain that the picture required is that depicted upon the screen; the case containing the dry prepared plates (of which more anon) is slipped into the camera, the glass exposed for a given period, according to circumstances, and then returned to its former position. This is all that need be done, and it is no exaggeration to say, that any Officer would require but a few minutes' instruction to be able to take three or four pictures in this manner within a quarter of an hour. On returning to camp, the plates are handed over to the photographic staff, with an intimation of the length of time they were exposed to light, and the negatives would then be developed, and printed in the ordinary manner.

These field pictures should, as a rule, be taken of small size, not larger, for instance, than can be obtained with an ordinary stereo-camera, an instrument of very considerable value for out-door work. A large camera is, of course, a necessary adjunct for field purposes, as it is only by means of an apparatus of notable dimensions that plans can be reproduced; but, at the same time, the staff should be invariably provided with a small camera, the advantages of which are as important as they are numerous; it may be more easily worked, and with much less risk of failure; its action is always rapid, and often *instantaneous*, a quality of the last importance; it involves less expense, less bulky apparatus, and less skill in manipulation; and, furthermore, the pictures produced by it may subsequently be enlarged to any desirable size. Indeed, in a hot, sunny climate, such as is encountered in the tropics, the instantaneous action of these small cameras is frequently a source of inconvenience, owing to the extreme sensitiveness of the collodion; the rays of light entering the camera may, of course, be diminished by employing diaphragms with small apertures in front of the lens to cut off the light; but inasmuch as a photograph becomes distorted and useless for enlarging, if the opening of the diaphragm is less than one-fortieth the focal length of the lens, the only course for the photographer to pursue in such cases is to modify the sensitiveness of his collodion. This may be done by diminishing the amount of sensitizing salts, as the rapidity with which a collodion acts is governed mainly by the quantity of these salts contained in it; and if required for landscape work, where much detail and half tone is necessary, the proportion of bromide to iodide should be large. Five equivalents of bromide to one of iodide would probably be a good proportion to use, provided the dipping-bath employed, were so prepared as to prevent the fogging of the negative. In compounding collodions for hot climates, it would, moreover, be well to employ a maximum quantity of alcohol, and to sensitize with those salts only which exert a liquefying action upon the material, as, for instance, the iodide and bromide of ammonium. These are, however, details the value of which, practical investigation can alone determine.

As an example of the manner in which photographic sketches attached to a military plan will aid in conveying a more perfect and truthful idea of the country represented, we will suppose lying before us a ground sketch of a fortified position, or entrenched camp. The plan might be required by the Officer Commanding, either previously to an attack, or to accompany and illustrate a report made to the authorities at home after the stronghold has been wrested from the enemy. A ground plan is sketched out in the usual way, with the roads, villages, rivers, and woods lying around, carefully marked, and an outline of the fort depicted as accurately as possible; around this plan are then placed photographs of the more important points of the fortress, the direction in which these pictures have been taken being shown by dotted lines marked upon the ground plan. These photographs may, if necessary, be taken at a considerable distance from the object, and then enlarged, one picture being a general view, showing surrounding country, another being a representation of the principal embrasures, a third showing the ditch or palisade surrounding, &c. Thus, constructed, a plan could not but fail to show immediately the position of affairs, and the Officer commanding, or authorities at home, would rest assured as to the accuracy of the representation, and be quite certain that the same has not been exaggerated or overdrawn.

Indeed, this method of making reports through the medium of photography is by no means a novel idea, but has been acted upon continually by several large firms of contractors. Thus, Messrs. Brassey and Betts, whilst recently constructing a railway in South America, trusted almost implicitly to photography as a tell-tale, or registry of the progress of the work. A photographer was stationed by them on the site of the railway, and when the periodical reports were made to the contractors in London, announcing the completion of certain portions of the line, and requesting the money advances agreed upon, these documents were invariably accompanied by a series of photographs supporting the statements as to the forward condition of the undertaking. In Russia, and other countries on the Continent, like arrangements have been made, thus obviating the necessity for the contractor's presence in countries where they may be disinclined, or unable, to take up their residence.

Among other miscellaneous services which the camera would fulfil to advantage, there is one connected with Naval matters deserving of mention. It has formed part of a vessel's duty, on more than one occasion, to pass rapidly in close proximity to an enemy's batteries for the purpose of obtaining a glimpse of the strength thereof. In fulfilling a task of this kind, a small, quick-acting instrument would be of the utmost value in taking a series of instantaneous views, which would record information in the most precise and reliable manner; a finder, or small camera, fixed rigidly to the larger one, would be required to indicate the right time of exposing the plate, an operation which would take place as soon as the image to be secured is depicted upon the focussing screen of the finder. In performing manipulations like these, it would be imperatively necessary to secure a suitable opportunity when the enemy's works are favourably lighted up, and to ascertain by previous experiment that the apparatus and chemicals are in good working order.

In the course of these observations I have pointed out how much may be done in photography in a rough and ready manner, and with but slight experience of the process; but for all that I do not mean to say that a photographer's duties in the field are unbeset with difficulty. On the contrary, it requires considerable experience, and sound theoretical, as well as practical, knowledge on the part of the chief photographer when working for a lengthened period continually in the open air. The mishaps and unforseen dilemmas which encounter the operator at home are by no means few or unimportant, but when the processes, both of obtaining negatives and printing from them, have to be performed without the usual appliances, and recourse had to a variety of makeshifts, misfortunes are apt to arise which require the exercise of considerable skill and patience to overcome. The manipulation of the various chemicals according to the heat of the climate and intensity of the light, the detection and prevention of failures in the process, the power of devising suitable improvisations in cases of need, must be well understood to ensure successful results in matters of detail; while it is absolutely necessary for the production of a good negative that the photographer should enjoy the utmost freedom in his mode of operating, and be allowed to perform his duty in his own way, in order that due attention may be paid to the manner in which the object is illuminated, to the position of the camera, to the time of manipulating, and to various other points of a technical nature. That a good photograph is no mere mechanical result, but dependent upon the skill and judgment of the operator, is at once apparent from a glance at the beautiful art productions of Mr. H. P. Robinson and Mr. Rejlander.

For these reasons, therefore, it is very desirable that the head of the photographic staff in the Field should always be a responsible person and likewise a Commissioned Officer, to whose judgment and discretion the manner of performing the various photographic duties would be left; thus the possibility would be avoided of pictures being attempted against all technical rules and theoretical principles, and worthless results being obtained in the endeavours of the operators to execute impossible orders given them from time to time by Staff Officers unacquainted with the exigencies of the art.

The important advantages accruing from the use of dry-plate-photography in the field, are very obvious. The large, cumbersome, dark tent, the stock of chemicals and utensils, the apparatus required for the preparation and development of the negative, are all unnecessary, the camera, stand, and plate-box, or two or three dark slides, being all that is required. Besides the saving of trouble, there is, moreover, the saving of time to be considered, for with the dry process it is requisite merely to expose and withdraw the plate from the camera, postponing all other operations until a more convenient opportunity; it may be some hours or even days afterwards. With a wet plate however, there is the process of coating the plate, immersing it in the silver bath, and subsequently developing the image, operations which consume a notable amount of time, and which cannot be hurried over without greatly jeopardising the value of the result.

During the past twelve months I have studied with some care the question of dry plates, their mode of preparation, keeping qualities, and adaptability to employment in the Field, and for military purposes in general. The preparation of preserved sensitive plates was due in the first instance to Mr. John Spiller, F.C.S., recently in charge of the General Photographic Establishment, who in conjunction with Mr. W. Crookes, F.R.S., prepared and experimented with them as early as the year 1854. Since that period, considerable improvement has been made in their preparation, and at the present time dry plates may be obtained possessing the same degree of sensitiveness as a plate taken direct from the silver-bath. The manner in which plates of this kind are produced is very simple. A sheet of glass is coated with collodion and dipped in the silver-bath in the ordinary manner to render it sensitive; after being thoroughly washed, a preservative solution is poured over the surface, and when it has again been rinsed and dried, the operation is finished. The degree of sensitiveness possessed by a dry plate, and the period of time during which it retains this sensitiveness, depends principally upon the nature of the preservative used, and also upon the care exercised in preparing the plates. Substances of almost every description have been used as preservatives—tannin, honey, coffee, tea, gum, albumen, morphine, syrup, &c., but my experience leads me to the conclusion that the best and simplest dry-plate processes are the gum-method of Mr. Manners Gordon, and that of coffee proposed by an Officer of the Italian Army, Colonel Baratti. The gum-process is preferable when sensitiveness is the main point to be observed, the coffee, when it is likely that a long period of time may elapse before employment of the plates. I have known coffee-plates to retain their sensitiveness after being stored away for a period of fifteen months; at the same time it is never well to employ dry plates more than a month old in any case where a reliable and perfect result is desired. As a proof that dry plate photography is already an established fact, I may mention that one of our best landscape photographers, Mr. William England, recently obtained a series of 400 dry-plate pictures during a tour on the Rhine. They were prepared with albumen, and the results are fully equal to those obtained with wet plates.

I now proceed to a point of considerable importance, and one which has caused the advocates of photography no little anxiety; I allude to the questionable permanence, or rather instability, of ordinary photographs. Many of the prints we possess, taken ten or fifteen years ago, show unmistakeable signs of fading, and even those which are still whole and free from blemish will, in all probability, suffer perceptibly after a few score of years. This liability of albuminized prints to fade, and even to disappear altogether after a lapse of time, is one of the most serious defects connected with the printing process at present in ordinary use. Look at any collection, portfolio, or album of prints that have been in existence for some years, and there will be found many which, if they do not show distinct signs of disappearing, have at any rate lost to a marked degree their pristine freshness and brilliancy. This tendency of photographs to deteriorate is to a great extent inherent to the mode of their preparation, and cannot always be guarded against. The surface on which the prints are produced, consists of a sheet of fine white paper, coated with a film of albumen, to which a suitable chloride has been added in minute proportion. By floating upon a solution of nitrate of silver, the chloride in the albumen becomes transformed into chloride of silver, and gives up the element with which it was previously combined. The chloride of silver now present in the albumen film renders the latter sensitive to light and capable of being printed upon under a negative, the result thus obtained being toned down to an agreeable colour by means of a suitable bath containing a compound of gold in solution, and finally fixed in hyposulphite of soda, and well washed. The operation of washing, to free the print from all traces of hyposulphite of soda, is one of the most important connected with the printing process, as the presence of the slightest quantity of sulphur in the finished print must eventually bring about a reaction upon the silver, and the destruction of the picture. It is by reason of imperfect washing that so many of our ordinary photographs become discoloured and faded, but at the same time even the most careful treatment in this respect will occasionally fail to remove the destroying agent, which remains locked up in the albuminous film, defying all efforts made to remove it. The sulphur contained in the atmosphere, likewise exerts an injurious influence upon silver prints, and on this account it is customary to coat valuable pictures with a film of impermeable varnish, to preserve them as much as possible from atmospheric influence.

It is because of the instability of silver prints that attention has been of late years directed to the discovery of a process by which pictures of undoubted permanence may be obtained. Many methods have, from time to time, been proposed, and at the present moment there exist two sound practical processes by which the desired object is secured. Both these inventions, which are now competing for public favour, are due to investigators in this country, the first the carbon-process, eminating from Mr. J. W. Swan, of Newcastle, and the second the Woodbury photo-relief process, the invention of Mr. Walter Woodbury.

Both processes are based upon the effect which light has upon the bichromates of ammonium and potash when in contact with an organic substance. It is well known that if upon a sheet of white paper coated with a solution of bichromate of potash there is laid an opaque design (such as a fern leaf), and the surface exposed to light, the sun's rays will act upon the uncovered portions of the sensitive film and convert the same into an insoluble chromic compound; so that if the sheet is subsequently washed in water, that portion of the surface protected from light is washed away (being still soluble), while the other parts remain unaltered and attached to the paper, forming a representation of the object previously placed thereon. This action of the sun upon the bichromates is the keystone of the two processes, which differ, however, from one another in this essential particular, that whereas in the carbon-process light is necessary in the production of every single print, in the Woodbury type its action is only required in making the first matrix or mould from which several hundreds, or even thousands, of impressions may be obtained.

The carbon or autotype process has lately been much simplified, and may be briefly described as follows:—A finely-ground pigment of any desired tint is mixed with a certain proportion of gelatine; the two substances are well incorporated and applied to the surface of fine paper, which is then termed carbon tissue. This tissue is floated upon a bath of bichromate solution, which impregnates it, and so renders it sensitive; after exposure to light under a negative for a sufficient period, the print is soaked in water and placed face downwards upon a sheet of glass or other impermeable surface, to which it becomes firmly attached owing to the suction of the gelatine when swollen with moisture. Immersion in warm water succeeds, an operation which has the effect of removing the paper backing of the tissue, and of dissolving away that portion of the gelatinous compound unacted upon by the light; gradually all that is soluble disappears, and there then remains attached to the glass an image formed of insoluble pigment. We are, however, looking at the image from the reverse side, or from the back, for in the first instance, it will be remembered, we placed it face downwards upon the glass surface; we must turn it round, therefore, an operation effected by attaching to the image a sheet of thin paper by means of an adhesive material, and when dry tearing the same again from the glass, together with the carbon image. Pictures thus produced are of the most durable kind, especially if subsequently treated with a solution of shellac in ammonia, which converts the gelatine into a species of leather. The beauty and detail possessed by these photographs are quite equal to those qualities exhibited by silver pictures, and carbon prints are moreover much less likely to become stained or injured from rough or careless usage.

In the Woodbury-type-process, the prints are obtained by *mechanical* printing. A stout sheet of gelatine is impregnated with bichromate solution, to render it sensitive to light, and then placed in the sun under a negative. This operation finished, the surface of the gelatine is carefully washed, to remove those portions which are still soluble, and the result is a picture in relief; where the negative was transparent, the rays of light have acted upon the bichromated gelatine and rendered it insoluble, but where the negative was opaque, the light has had no effect upon the surface, and in these parts the gelatine, being still soluble, is easily washed away. This gelatine matrix is hardened by immersion in alum, and then placed between two plates of type metal, and subjected to considerable pressure; the result is an impression or intaglio in the metal plate, or, as we may call it, an engraved design. From this the printing is thus proceeded with:—A sheet of paper is placed in position, and upon it is poured a little pool of black transparent ink; the engraved plate descends, presses out the superfluous ink, and produces a fac-simile of the original photograph. The shadows in the picture being represented according to their intensity by cavities more or less deep in the metal plate, a thicker or thinner layer of the transparent ink is thus allowed to remain upon the paper in those parts, while, on the other hand, there being no depression in the plate where the high-lights are represented, the ink is forced away from those portions, and the white paper remains uncovered by any colouring matter. The gradation of tone in the picture is therefore obtained by layers of ink of unequal thickness. Thus the Woodbury-process produces prints of great stability, and without the aid of the sun, except in the preliminary production of the gelatine matrix; this latter will serve to furnish a dozen engraved plates, and therefore by one single exposure to light we may obtain thousands of prints.

From this it will be readily conceived that the Woodbury and carbon processes are both essentially practical and worthy of adoption; where a large number of prints are required, say a few hundreds from each negative, the Woodbury process would be more suitable, but where from ten to a hundred copies only are necessary, the carbon process would appear better adapted for employment, as the expense of carrying on the first named process on a small scale would be proportionately great. In the General Photographic Establishment at Woolwich, operations of an experimental nature have been carried on with the carbon-process with some degree of success, and in the course of the present year it is believed that all prints issued from Woolwich will be of an absolutely permanent character.

There is one subject to which I cannot refrain from alluding, before leaving the question of permanent photography, a subject which appears to me of weighty import, although perhaps somewhat out of place in this paper. Proposals have been made from time to time, and among others by a Mr. MacLachlan of Manchester, as far back as 1863, that a national gallery of photographic portraits should be formed of personages distinguished in arms, literature, science, art, &c. These propositions have been combated on the score that photographic productions are themselves unstable; but now that we are possessed of a means of producing permanent pictures in a simple and inexpensive manner, the adoption of a scheme of this kind would involve but little labour and trouble, while the value of such a collection would be incalculable. Engravings and oil paintings always partake of the ideal to a certain extent, and are frequently far from being faithful representations of the great men they purport to depict, whereas in a photograph, we see a true and faithful delineation of the features, exactly as they are reflected from the original upon the camera screen. If the formation of such a collection be contemplated, either through public or private enterprise, no delay should occur in its establishment, and steps ought at once to be taken to secure the negative-portraits which at present exist of men of note who have already left us, otherwise in our apathy these valuable mementoes may disappear and become lost to us for ever.

In concluding these remarks I have to point out the extent to which photography is employed in the various foreign War Departments, merely observing that my information in this respect has been collected in most instances from reliable sources.

America.—During the recent American war, the value of photography was well appreciated, although its employment appears to have been merely resorted to for the multiplication of maps and sketches of the enemy's country. For planning campaign raids, expeditions, &c., these photographs were found to be exceedingly useful, so much so indeed that upwards of 4,000 of them were prepared during the period of the war. Besides the work done at head-quarters, each division of the Army had a photographer attached for performing special duties in case of need. A considerable saving of time was frequently effected by employing the camera in this connection, especially during the period preceding a fight, when sketches were wanted for distribution to different corps and division Commanders. Previously to General Sherman's departure on his decisive expedition, all plans relating to the topography of the proposed route were collected, and upwards of 100 copies of each prepared for distribution throughout the General's command.

At the present time, photography is employed by the American Government at the Army Museum, at the United States' Coast Survey Office, and at the Treasury, but at none of these establishments is the process used in any special manner.

France.—In France, for some time past, much attention has been paid to methods of employing photography in the War Department, and more especially in connection with military surveying. The Chevalier plane-table has been experimented with, with fair success, and further investigations are now being made with it by the Minister of Marine at Toulon. Unfortunately, the inventor of this ingenious instrument has recently died, and it is feared that many important applications and perfections, which he had elaborated, have thus been completely lost. According to M. Chevalier's statement to the Emperor, he professed himself to be able, by means of two photographs taken with the plane-table, firstly to regulate in the most certain manner during the night, the direction of fire and the precise angle at which the electric-light reflectors employed against any point of attack should be adjusted; and, secondly, to regulate convergent fire, either from one or several batteries, against a fixed point, as easily by night as by day. So plausible did M. Chevalier's proposals appear to the Emperor, that a series of experiments was ordered to be undertaken in this direction as soon as the Toulon inquiry had terminated, but in the meantime M. Chevalier's death has unfortunately occurred.

The production of military plans and maps is undertaken with the aid of photography at the French War Department, in pretty nearly the same manner as at Southampton; but there is one application of the art which appears to have been found exceedingly practical and successful, and which might with benefit be adopted into this country. The sealed patterns of articles of field equipment and other warlike necessaries are photographed on a small scale, and prints, with descriptions attached, distributed to Army Storekeepers, Commanding Officers, and other heads of departments. By the adoption of this course, when the supply of any particular store is necessary, the Officer demanding the article is incapable of making a mistake either in the nomenclature or description of the store required, thus preventing any loss of time occurring from incomplete or erroneous instructions. Mistakes and delays of this kind were formerly not of unfrequent occurrence in the correspondence between different branches of the War Department, and in demands received from colonial stations, but by this simple precaution the supplies of war material are now said to be greatly facilitated. In this country we have already an exceedingly complete catalogue prepared by the Controller of Stores at Woolwich, comprising every description of warlike implement, and it would certainly be a valuable addition to this volume if photographic illustrations of some of the more important articles were added in the form of an appendix.

Austria.—In the late German war no steps were taken by the Austrian Government to employ photography in the field. In the Military Geographical Institute, however, a numerous series of plans of the more important towns and fortresses of Prussia and Saxony were prepared by means of the photo-lithographic and ordinary photographic methods.

Belgium.—The Belgian War Office employs photography to a considerable extent in their Topographical Department, frequently using the process of printing by development, when copies are required without delay.

Holland.—In Holland there exists a photographic establishment in connection with the Ministry of War; it is stationed at the Hague, and is under the direction of Captain Van der Beeck. Photo-lithography has been used in this establishment to some extent, in preparing a collection of sketches, of artillery requisites. Chromo-lithographic maps are also prepared, as likewise other prints and designs for military purposes.

Prussia.—No official use was made by Prussia of photography during the late campaign, although it is mentioned on good authority that a short time previous to the breaking out of the war, the art had been employed by the Government for securing landscape views of Bohemia and other interesting localities. The formation of a photographic establishment has, however, just been decided upon, although no definite steps in regard to it have yet been taken.

Photography thus serves some very important purposes in connection with the pursuit of warfare, purposes which will, no doubt, become more extended from day to day as the art progresses towards perfection. That we shall soon witness this consummation there is every reason to believe, more especially when it is remembered that the radical improvements already effected, have all taken place within the space of thirty years; for although more than half a century has elapsed since a reflection of nature was first caught up and secured in the camera (May, 1816) by Nicéphore Niépce, a sub-Lieutenant in the French Army, no information on the subject of photography was made known until his surviving partner, Daguerre, published the Daguerreotype process in 1839. The art of photography, as it exists at present, is widely different from the processes of MM. Niépce and Daguerre. Those gentlemen made us acquainted with theoretical photography only, and it is due mainly to the exertions of Mr. Fox Talbot, Mr. Archer, and Sir John Herschel, that the art has reached its present advanced state and been rendered practicable to all the world. It would indeed be hard, then, if the Science of War could not derive some aid from this universal process, of which a soldier was the principal originator.

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VOL. XIII. 1869. No. LVI.

Evening Meeting.

Monday, June 14th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAME of MEMBER who joined the Institution between the 7th and 14th June, 1869.

ANNUAL.

Bridson, T. R., Capt. 7th Royal Lanc. Militia, 1*l*.

"THE LAUNCH OF H.M.S. 'NORTHUMBERLAND.'"

By Rear-Admiral Sir JOHN C. DALRYMPLE HAY, Bart., C.B., M.P., F.R.S., &c.

SIR JOHN HAY: The circumstances of my appearing before this meeting to read this paper is one that, perhaps, deserves some apology. The fact is, that not only in looking over the records of this Institution, but in looking over other records, I found abundance of information as to the process of building ships, and a great deal of information as to what we ought to do with a ship after she is launched, but the actual process of transferring the ship from the place on which she is built to the water, is nowhere described, scientifically. It is described, of course, in various forms in newspapers, where we see accounts of the launches of ships; but there is no information available for an Officer or any person engaged in ship-building, who wishes to ascertain how actually to launch a ship, as to what the arrangements for a launching are. It so happened that I had something to do with the launch of the "Northumberland" some years ago; and when I was endeavouring to describe it to my friends, and was anxious to describe accurately what had passed, I found when I came to reduce it to writing, the truth of Lord Bacon's famous maxim, that "speaking makes one a ready man, reading makes one a learned man, and writing makes one an exact one." I found when I came to reduce this account to writing that I was not at the first attempt so exact as I could have wished. Therefore, I am extremely happy to see one gentleman present this evening to whom I am indebted, Mr. Luke, a gentleman connected with the Admiralty, who gave me a great deal of technical information; in fact, almost the whole of the technical information embodied in this paper, and enabled me exactly to describe what occurred. All I claim credit for is, the having reduced that information into a form in which I thought it might be useful to this Institution to put on their records, so that anybody having such heavy bodies as this ship to move under such exceptional circumstances, might be able to refer to those records for information on that point. I claim no further originality for the paper than that. With the permission of the meeting, I will now read the paper which I have drawn up with the assistance of Mr. Luke, and which I presented to the Council of this Institution some time ago, to be placed on their records.

The launch of Her Majesty's Ship "Northumberland" is the subject which I propose to describe this evening. It has a twofold interest.

Firstly, because of the immense weight successfully set in motion, and

Secondly, because of the mechanical contrivances by which that motion was obtained and controlled.

No doubt many whom I address are far more competent than I am to illustrate such a subject, but as circumstances placed me in a position to watch the building of that ship, and in some degree to aid in her successful launch, I am perhaps more able than most people to relate the transaction.

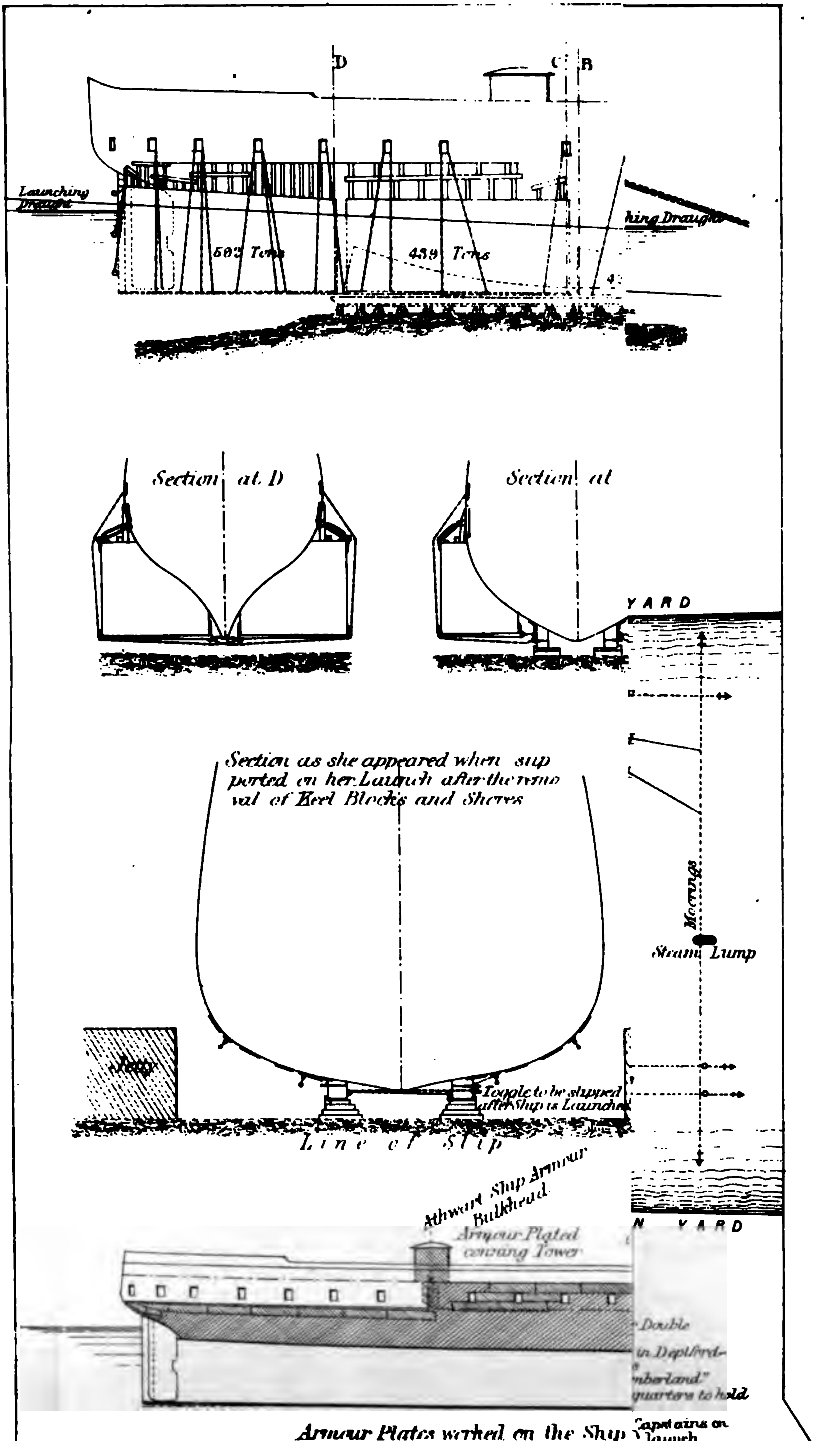
In the year 1861, it was decided to build three iron-clad ships of such a size that no difficulty would exist in clothing them completely with thick iron armour.

Up to this time our largest ships, such as the "Warrior" and the "Black Prince," were only armour-clad in that portion of the ship in which the guns are usually mounted; and about 170 feet in length, part at the bow and part at the stern, was not coated with iron armour. This mode of construction was adopted to relieve the extremities of the ship from a weight which would have made her much less buoyant and safe at sea. But in order to protect the ship from being easily sunk by shot which might penetrate the bow or stern, the ship was divided into many compartments, so that only those which were perforated should fill with water.

These compartments were in themselves a source of weight, and rendered the ship less convenient than if less subdivided.

It was found that by increasing the tonnage of the "Warrior's" class by about 600 tons, ships might be built completely armoured, and yet in all respects fit for sea.

For this purpose the "Minotaur," the "Agincourt," and the "Northumberland" were commenced in 1861.


D
C
B
Launching Draught
hing Draught
602 Tons
439 Tons
Section at D
Section at
YARD
Section as she appeared when supported on her Launch after the removal of Keel Blocks and Shores
Moorings
Steam Lump
Jetty
Toggle to be slipped after Ship is Launched
Line of Slip
Athwart Ship Armour Bulkhead.
Armour Plated conning Tower
Double
in Deptford
nberland"
quarters to hold
Captains on launch
N YARD

Armour Plates worked on the Ship
Do to be fitted to complete th
Scale
d. as she goes off
on board Northum

ll now describe these ships, which are almost identical, though light changes were made at a late date in the arrangement of nour of the "Northumberland," by reducing the weight of some armour at the extremities, in order to enable the authorities to e her armament by giving this ship very heavy guns.

ngth of the "Northumberland" is	400 feet
h, extreme	59 ft. 3½ in.
of hold, *i.e.*, lower deck to keel	21 ft. 1 in.
depth	42 ft.
ge—builder's measurement	6,621 tons
power of engines, nominal	1,350 h.p.
load draught	25 ft.
t of portsill from water	9 ft.
ır-plated below water	6 ft.
ller, Griffith's, four-bladed, diameter	24 ft.
	28 ft. 6 to 22 ft. 6 in.
ır-plates, 5½ inches, tapering to 3 inches forward aft. and 2 inches under the counters. The wood king of teak being 9 inches thick amidships, and red to 6 inches forward and aft.	
nt of armour-plates on the ship when launched	1,247 tons
g the total weight launched	7,100 tons

s difference, however, is to be observed in the three ships:—

"Minotaur" was launched from the Thames Iron Works with 40 tons of armour-plates on her sides. The rest were added she was water-borne and in the basin.

"Agincourt" was built and completed by Messrs. Laird in a ck, and was floated out of it when complete.

"Northumberland" was armour-clad (all but a few plates) launching, and thus was the heaviest body ever moved along a launch.

y a single launch, because the "Great Eastern" was launched eral ways, and was built broadside on the river, so that the keel t right angles to the launch; whereas the "Northumberland" unched stern foremost in the ordinary manner.

here it may be advisable that I should endeavour to describe, guage as devoid of technicality as possible, the process of launching hip.

s are generally built on blocks of wood or piles placed at short ces, on which the keel is laid.

upper surfaces of these blocks are placed so as to show a cons inclination or declivity of from ½ an inch to ⅝ths of an inch in ot.

keel thus slopes towards the water at the inclination best suited condition and depth of water of the river or harbour that is to the ship. If the vessel is small and short, and the water deep, is every advantage in a rapid descent. If the vessel is large and heavy, then a slower and more gradual launch is more desirable, and the more so when, as in the case of the "Northumberland," the vessel was so long and the water so shallow, that a descent at too great an angle might have caused the stern post of the ship to strike the bottom of the river before the bow was clear of the slip, and the vessel fairly afloat.

Well, as I have said, ships are generally built on piles or blocks placed at an angle, and as the structure rises on each side of these blocks, and the sides of the ship are formed, it is supported by shores or props of timber, the lower end of each resting on the bottom or sides of the slip or dock in which the ship is being built, and the upper end against a portion of the side of the ship.

Each shore is made to receive its fair share of the weight of the ship by means of wedges driven in at the heels of the shores.

When the ship has been completed to a fit state for floating or launching, her weight has then to be transferred from the blocks on which her keel has hitherto rested, and from the shores which support her sides, to the sliding-ways down which she is intended to be launched, into what is called, rather inappropriately, her native, but more justly her adopted element.

On each side of the blocks on which the keel is resting are other piles or blocks, and on them are built the sliding-ways. These are formed of thick plank, the whole made strong enough to bear the weight of the ship.

The outer edges of the sliding-ways are placed so that the whole shall be a little wider than one-third of the extreme breadth of the ship, or one-sixth of the extreme breadth of the ship on each side of the keel. This arrangement makes it obviously impossible for a ship to tumble over on her side.

Under the ship is built a cradle with a smooth under surface resting on the smooth upper surface of the sliding-ways.

So long as the ground and cradle are not crushed or compressed, the ship must be firmly balanced.

For the cradle, on any given side, would only have one-third outside and two-thirds on the other side to hold it.

Persons unacquainted with the principles and practice of launching ships, often express their surprise when they first see so much of a ship apparently unsupported, and overhanging its cradle, and very naturally entertain fears lest she should topple over; but as above explained there can be no danger.

The sliding-ways for large ships of ordinary weight are each from 2½ to 3½ feet broad (in the "Northumberland's" case they were 3½ feet broad), and their inclination and declivity are governed by the size of the ship, rise and fall of tide, depth of water, and other circumstances, which the person responsible for the launch has to consider before he determines the degree of inclination at which the ship is to be built and launched.

The sliding-ways, as already described, have about five-eighths of an inch to the foot of inclination, and in many cases this is arranged to *increase* as it approaches the water. This construction is adopted partly to give a camb or curve to the centre of the ways to obviate any tendency to sink there from the weight of the ship, and partly to assist the ship in her descent into the water, as the immersion of a part of the ship has a tendency to arrest her progress into the water.

In the case of the "Northumberland," the higher end of the sliding-ways had an inclination of $\frac{6}{10}$ths of an inch to the foot. At the centre $\frac{65}{100}$ths, and at the lower end about $\frac{3}{4}$ of an inch to the foot.

On the outer edge of the sliding-ways are fixed what are called "ribbands," to keep the ship in the proper line for launching, and to prevent the cradle from slipping off the slides.

The upper surface of the sliding-ways, or fixed ways, and the under side of the bilge-ways, or moving ways, are thickly coated with melted tallow, oil, and patches of soft soap. The bilge-ways are then placed on the sliding-ways, the two greased surfaces coming together.

The space between the top of the bilge-ways and the bottom of the ship is filled in amidships with solid pieces of fir timber, and forward and aft with shores or vertical pieces of timber called poppets, their lower ends resting on planks, which again rest on broad oak wedges, placed nearly close together, the whole length of the cradle, on the inside next the keel, and on the outside next the ribband between the solid plank and the bilge-ways.

When the cradle has thus been formed and completed, and it is time to prepare for launching, these wedges are simultaneously driven in by a very large number of shipwrights with mauls (or large iron hammers), and the weight of the ship by the power of these wedges, is thus transferred, from the keel blocks and shores on which the ship since her commencement has hitherto rested, to the cradle resting, as already shown, on the sliding-ways.

On each side of the cradle near the bow, is a large piece of timber, with one end against the bilge-ways, and one end against the sliding-ways, and these two act as pauls to hold the ship up to the moment of launching. They are called the dog-shores.

When nearly time for launching, the keel blocks (with the exception of three or four left to assist the dog-shores in preventing the ship moving too soon down the sliding-ways) and the shores are removed, and the ship is then suspended on the cradle ready for launching.

When the time arrives for launching, which is generally about a quarter of an hour before high water, to ensure launching at slack water, the dog-shores are simultaneously knocked away, and the ship slides down the greased incline-planes into the water.

As soon as the ship is afloat, the cradle, which is not fastened to the bottom of the vessel, floats up from underneath and the ship is free. For these remarks as to the general nature of a launch, I must apologize, observing that they will make it much more easy to understand what is now to follow.

I must beg of you therefore to imagine H.M.S. "Northumberland" prepared for launching in the mode I have endeavoured to describe. It was the 17th of March, 1866. The Prince of Wales and a gay and joyous company had assembled to see the "Northumberland" enter the Thames from her slip in the Millwall Ironworks.

Just before high water, the dog-shores were knocked away; the Countess Percy bestowed the highest title of her house upon the ship, and after some pressure from hydraulic rams the "Northumberland" commenced her descent into the river. At first she seemed to move sluggishly, but gradually her pace increased, then some hesitation, and then after having moved 178 feet, she suddenly came to a stand-still. The cheering crowd were all silenced. Dismay was pictured in every countenance.

The company at length dispersed; but for a month the failure to launch the "Northumberland" was a general topic of discussion, and during that period measures which eventually proved successful were gradually matured by the officers of the Millwall Company, assisted by the able advisers whom the Admiralty placed at their disposal, by the efforts cordially made by the Royal Dockyards in the Thames, and by the goodwill and hearty co-operation of the workmen at Millwall and the officers, seamen, and marines who assisted them.

When the tide left, it was seen that the afterpart of the bilge-ways had only gone about 25 feet beyond the sliding-ways, and that the ship rested securely on her cradle without straining. No harm was likely therefore to happen to so strong a structure; and in fact none did arise, as the ship only deflected $\frac{7}{16}$ths of an inch in 342 feet, after she stopped until she was finally launched.

From this time forth every inventor in the country had nostrums to suggest, and it was not for lack of counsel that the "Northumberland" remained immovable for a month. Above 400 plans for releasing her were submitted to the persons connected with the undertaking. Many suggested gunpowder as a means of blowing her off into the river. Some suggested lifting by means of balloons, and one actually proposed to fill her with gas, and so to allow her to lift herself off the slip on which she was built. A proposal was made in sober earnest to fill the dock with peas, which opening and expanding in the water would lift the ship and allow her to glide down their smooth and swollen surfaces.

A countryman of mine well known and of considerable chemical reputation, came to me one morning, and I must do him the justice to say, gratuitously tendered me his advice. I was busily engaged watching the operations when I was told that a gentleman wished to see me. After a close examination and some preliminary conversation, he said, "Sir John, if you'll alloo me I'll tell ye hoo to get her off. Ye know what the mainsail of a ship's made o'—stoot number-one canvass. Well, jist tak a great wab o' that and spread it oot across the river. Attach the two corners to the dock, and to the ither two corners attach two quick river steamers. Make them steam swiftly to the shore. They'll roll in a great volume of water. It will float the ship and the returning wave will jist set her doon whar ye want her—in the river." I thanked my kind friend, and promised if present arrangements failed, to consider his proposal.

At high water on the 18th of March attempts were made by means of hydraulic rams, tugs, capstans, and other appliances, to haul her off, but as might have been expected without success.

It was then decided to postpone any further attempts to launch her till the next spring tides, and in the meantime to remove and re-grease a portion of the launch at the forepart, and to provide means for lifting the ship between the afterpart and midships, so as to lighten her and raise her weight off the ways where it was believed that the grease had been squeezed and burnt out by the friction. It seemed certain that owing to the great and continuous pressure, the surfaces of the bilge-ways and sliding-ways had been brought into cohesion so that it was necessary to tear them asunder, and it was also desirable to throw the weight on the newly greased ways at the forepart of the launch.

Blocks and shores were accordingly again placed under the ship to support her.

About fifty feet in length of the fore part of the launch was removed, this length of slides re-greased and launch replaced, and a new or supplementary launch was built inside the bilge-ways forward, which was also continued for the whole length of the sliding-ways. This was done for the purpose of giving an increased surface, and so diminishing the friction.

Twelve camels or pontoons were built, having a total lifting power of 370 tons, and placed under the after portion of the midship body of the ship. Eight mooring lighters, with a total lifting power of about 400 tons, were placed under the counters, and lashed down at low water by chains passed under the keel. A hydraulic ram, with a pushing power of 800 tons, was placed against the stem of the vessel, and two of 450 tons-power each, were placed, one on either side, to push against the fore ends of the cradle. Cables from lighters in the river were brought to capstans on board, and a steam-dredge moored in the river brought a cable from the ship to her drum, which, with the addition of several powerful steam tugs, were to assist in hauling her off.

These arrangements were completed by the 30th March, and on the 2nd April an attempt was made by these means to move the ship. They failed however to do so.

The difficulty of bringing an equal strain on the chains which attached the mooring lighters caused some of them to snap; thus the comtemplated assistance from the lighters was not obtained, and the camels, which acted admirably, had not sufficient lifting power.

None of the means applied had however been wasted; and except the chains which lashed the lighters, no useless expense had been incurred. It was evident that the reliance which could not be placed upon vessels or lighters, might fairly be placed on camels or pontoons. The lighters could not be closely lashed to the ship, and immense strain was therefore brought upon the chains which attached them, whereas the form of the camel could be adapted exactly to that of the ship, and the pressure of the water but attached it more firmly.

It was therefore decided to incur the additional expense of building four more very large camels, and to fit them to the after part of the ship, and also to support the ship again on blocks and shores as before, and shift as much more of the launch as could possibly be got at with safety.

By this means about 125 feet additional length of launch was renewed and re-greased, making 175 feet in all. Four large camels were built and secured under the quarters with a total lifting power of 2,000 tons. On each side, an additional hydraulic ram was placed against the fore end of each supplementary cradle, making altogether five hydraulic rams, with a pushing power of 2,400 tons.

Two steam-dredges were moored in the river astern of the ship. To each a 13-inch cable was brought, which was taken from them, passed through blocks lashed low down on the stern-post, and brought to their respective drums. Two 23-inch cables were taken from the ship to lighters moored in the river, which each supported large blocks, through which threefold purchases were rove and brought to capstans in Deptford Green-yard.

Another 23-inch cable was taken to moorings in the stream, and hove in by a threefold purchase on board the "Northumberland." Two line-of-battle ship's chains were secured to the quarters of the ship to keep her in line, if the pressure of the tide should tend to slew her. Two 13-inch cables on the starboard quarter, exposed to the tide, were brought to the upper deck capstans in the ship for the same purpose. A 12-inch cable on the port quarter for a similar purpose. A steam lump was also provided with a 10-inch hawser to gather in and hold the ship when it was necessary to slip all those which have been described; and another 10-inch cable was ready at the buoys to warp her to her place when safely afloat.

In case the tide should be high, as it proved to be, and the ship with all these means of flotation and motive power should become too lively, her bower-chains were attached to anchors in the yard, ready to slip at the moment of launching—and two hydraulic rams of 400 tons each, were placed under the forefoot, at such an angle as to offer some resistance to the ship's moving. They also were to serve another purpose. For being pressed upwards with great force against the ship it was calculated that by relaxing them suddenly the ship might be shaken on the ways and thus assisted in freeing herself.

In order that no means might be neglected, the space under the ship forward was filled with casks lashed low down so as to assist in lifting.

Furthermore, it was surmised that the ground-ways would rise with the ship as they were relieved of the enormous pressure under which they had so long groaned. To ascertain whether this were so, it was at first proposed to employ a diver, but the risk to life and limb would have been considerable, and two plans were devised to obtain this information. The one by Mr. Lungley the manager of the works, the other by Mr. Luke the accomplished Admiralty Officer who had superintended the assistance given by that department.

The first was composed of two fine chains, one attached to the sliding-way, the other to the ground-way, the ends brought up and rove through two pulleys adjusted to equal lengths and with weights attached to each. So long as the ship rose and the weights continued to descend, *pari passu*, it would be shown that the ground-ways were springing up and still pressing against the bilge-ways. So soon as the weight attached to the bilge-ways began to descend more than the other, it would be shown that a separation had at last taken place.

The other was a long graduated wedge with its fine edge adjusted exactly opposite to the opening between the two ways. A long lever worked by a handle was fitted so as to force it into the opening when it should be able to receive it, while the arc described by the lever registered the amount of separation as shown by the wedge. Both of these instruments answered their purpose and gave the necessary information.

Another precaution was taken. Valves were fitted in each camel, so that if owing to a high tide the ship should become too lively and too buoyant, then water could be admitted at pleasure into the camels, and their flotation regulated as might be desired.

The 16th of April was the day fixed for the launch; but one chain had not been properly secured, and it was deemed right to delay until the 17th. It was fortunate that it was so, for the enormous crowd that had assembled both in the dockyard and on the river, made it almost certain that some accidents of a serious character would occur.

The crowd, much disappointed, did not return in such numbers on the following day, though a sufficient number were there to witness the successful effort.

On the 17th the tide flowed to a considerable height, and at an hour and a half before high water, the instruments already described began to show that the ship was beginning to lift.

It had been decided beforehand that when a separation of one inch and a-half had been shown to have taken place between the bilge-ways and the sliding-ways, at the junction of the old and new ways, water should then be let into the camels to maintain this amount of separation.

From about an hour before high water then, water was gradually admitted to the camels, and so carefully, that the just separation was exactly maintained. Meantime all the cables were hove taut, and the ship longing to be free, was straining at her cable and grinding at the dogshores, like an impatient horse chafing at the bit. It would not do, however, to let her go; for an impetuous tide was still sweeping across her course, which if she had been allowed to enter, would have twisted her on the ways, and perhaps made her a complete wreck.

At last the tide slackened, the chains were slipped, the pressure on the rams under the forefoot was removed, the dog-shores were successfully knocked away, and the ship herself gently glided into the Thames. So ended this long and anxious labour, and the narrator of this, who had some opportunity during the process of encouraging the desponding, and stimulating his fellow-labourers, had the satisfaction to hear his name mingled with the vociferous cheers of those who had watched his endeavours and shared in his success.

The Chairman: Should any gentleman present wish to ask Sir John Hay any question, or elicit further information on the subject before us, I am sure that he will be glad to give it.

Commander W. Dawson, R.N.: I rise to make a few remarks, not with the view of eliciting information, but with the view of congratulating the Institution on the fact that an Officer of the distinguished abilities of Sir John Hay has come forward to give us exact information upon a subject upon which we younger Officers require some instruction. In my younger days I remember that in the midshipmen's berth the most popular books read were Harris's *Heaving Down Ships*, Key's *Recovery of the Gorgon*, Tinmouth's *Points of Seamanship*, our friend Sir Edward Belcher's *Nautical Surveying*, and other such professional works. I have always felt that we very much want records of the means employed in the actual performance of exceptional professional feats, such as that described by Sir John Hay. The Journal of this Institution, to a limited extent, supplies that *desideratum*, but I should like to see it do so still more. In one of the recent Journals there is a most valuable paper (carrying out the suggestion which I have ventured to throw out) from Admiral Inglefield, who described what the profession would never have otherwise known, viz., "the tactical performances of the Mediterranean Fleet." Now Sir John Hay has brought before us the details of a subject, on which younger Officers required information, and for which they will owe him many thanks. It is a point on which exact information is very much wanted. We cannot lay hold of a book in which to find detailed information with reference to the launching of ships. Though all of us read at the time with great interest the newspaper accounts of the launching of the "Northumberland," yet there are a great many additional professional details which Sir John has brought before us today, which it is most desirable to place on permanent record, and which I am sure will be read by the Officers of the different ships to which our Journal goes, with very great interest. My only regret is, that Officers with the experience of Sir John Hay, who have had the actual superintendence of exceptional seamanlike undertakings of this kind, do not more frequently come forward to describe them with such fulness of reliable detail for the instruction of younger Officers. I would venture to throw out a suggestion to the Council, whether it would be possible to induce the Admiralty to encourage Officers of the Fleet to supply information regarding any exceptional work that they might be engaged upon, for the benefit of their less fortunate brother Officers. Naturally Officers cannot furnish such information without the permission of the authorities, and they may perhaps be too modest to ask for that permission, unless positive encouragement be given on the part of the Admiralty to supply it. It is only those Officers who have actually had the conduct of such work, who can really supply the exact detailed information which is required, and which I am sure we shall all feel the need of when the day of trial comes, when we are called upon to carry out works of a similar nature.

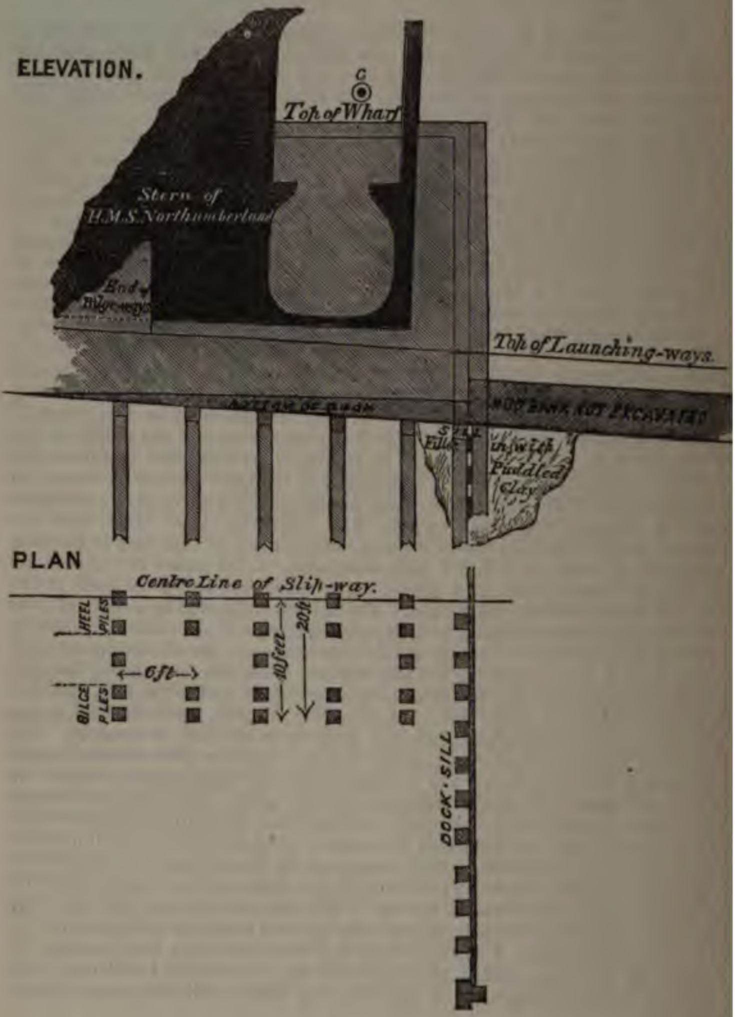
Admiral Sir **Edward Belcher**: Some allusion has been made in the paper to peas. I do not think Sir John Hay has fairly dealt with the question. The letter that I wrote upon the question of these peas had no reference whatever to placing the peas in the dock. There is a certain *modus operandi* by which you may deduce an enormous power from very trivial means. We know that no direct power that you can exert will rend millstones. But if we adopt the proper and simple power, that is, by using wedges of willow, baked and deprived of moisture, and drive them into ridges or channels cut round each stone, and allow water to flow down over the top (by the very same action), during the night the capillary tubes are filled and the courses are found to be separated. No one sees the separation in action, but it is known to take place from capillary action. In a similar way the Portuguese separate immense pieces of granite, as long as this room (20 to 30 feet in one piece), by the use of very small iron wedges, and very slight taps with the hammer. The Chinese also pursue the same course. After I wrote the letter alluded to, I took the trouble to have a set of cylindrical instruments constructed of sheet zinc, and at the following meeting of the British Association I placed it on the table of Section G, at Nottingham, and with one pint of peas I raised 1 cwt. one inch in twelve hours. Consequently, one cubic foot will raise 5,824 lbs. (or 2·6 tons). And if the power of the peas had been exerted in a proper manner, fairly brought into play, the "Northumberland" might have been moved. But the question was not whether she should be moved one inch, but a series of inches; and that result must have been carried out by a series of tubes, those tubes not exceeding 4½ inches in diameter. I would venture to say that by the ass of peas,* by mustard seed, or sawdust, a greater lifting or lateral power can be xerted than you can possibly gain by any mechanical powers that are known to you. Consequently the question of peas is not quite so ridiculous. I have the same implements at home; and if any one would like to see the experiment tried, I shall be happy to show them.

Mr. C. F. **Henwood**, N.A.: Before Sir John replies, I should like to make one or two remarks, inasmuch as the slip-way was built after my own plans, and the "Northumberland," herself laid down under my direction. A good deal of criticism passed at the time of launching this ship, as to the cause of her not being launched, as it was hoped she would be. If you will allow me, I have here a sketch of the slip-way and ship, which I think will enable me to explain readily the circumstances, and save a good deal of talking. I should like first to state the reasons for building the "Northumberland" in an excavated slip-way, or partial dock, and not as the "Minotaur." The "Minotaur" was built on, and was launched from the ordinary height, the same as the "Himalaya," and other merchant ships. In the case of the "Northumberland" it was contemplated to build over her an iron roof, the same as we have in all Her Majesty's dockyards. It became necessary, therefore, to build this large ship as low down as possible, so as not to require a greater height of roof than was absolutely necessary. That was one reason. Then we had another reason, and that was a commercial one, viz., we wished to utilize this slip-way after launching the "Northumberland" as a slip-way for hauling up ships for repairs, for the cost of it was between £7,000 and £8,000, which it would not have been judicious to have incurred for merely one ship. These were the principal reasons for building this slip-way or partial dock. The land is very treacherous; in fact, most of it is what is termed "made ground." It is not very solid, and the weight of the ship to be built upon it was very great. Moreover, it was intended to put on the whole of the armour-plating before launching; it therefore became necessary to compute the weight of the ship at the time for launching, and to give a sufficient foundation to support this great weight. The following sketch shows you the elevation and plan of the piles under the ship, and at the sill. The ship in building was supported on rows of 9 and 7 piles alternately, 6 feet apart throughout its length. This ship being built in a semi-dock, a coffer-dam had to be built at the entrance, and made perfectly water-tight. The sill was supported by a series of piles from side to side, planked and filled in with puddled clay, and was made considerably stronger than the slip-way. Now about the launching—all the circumstances were thoroughly studied when preparing the slip-way and the blocks for building the ship upon. The incline of this slip-way is three-quarters of an inch in the foot, and that of the blocks half an inch in the foot. In preparing this plan, I provided for giving the launching ways three-quarters of an inch declivity in the foot, if necessary. The actual declivity given was somewhat less, but I should not have been satisfied myself with less than ¾ in. in the foot. Yet I think, under the circumstances, there is no reason to doubt that there was a sufficient declivity given. Now, let me explain the cause of her stopping on the "ways." In launching, the ship rests in her cradle on the bilge-ways, which are supported on a series of blocks laid on the top of the bilge-piles. The ship then being chiefly supported by them,—and they afforded a uniform, but to a certain extent an elastic support,—there was not the same amount of rigidity in them as there was in the sill of the dock, and I found that in laying he launching-ways, blocks for their support were also laid on the *sill of the dock*, which hould not have been done. I firmly believe that this error was the sole cause of er stopping on the ways; and I think you will see with me that that must have een the case, the launching-ways at the sill being more rigidly supported than at ny other part.

Note.—It was found, further, that peas, after having exerted this enormous wer were not injured, and were, in fact, from the heat evolved, in a state of advanced getation, and on trial bloomed and bore fruit!

A cubic foot of space can only support (*less the weight of the material which encloses*) 42·5 lbs. of fresh, or 46·4 salt water.—E. B.

The position of the "Northumberland" in the dock before she started is shown in
sketch. Taking the centre of gravity of the weight of the ship at launching to



at about 200 feet from after side of rudder port, G, would represent its position w
she stopped; thus you will see that the centre of gravity of the ship was
before that very rigid part the sill, and thus the whole weight of the ship,
7,000 tons, bore on that one part, which acted as a powerful break to stop the
If a plan had been devised to stop the ship when gliding down that decliv

nothing could have been devised more efficient than what was done in this case by pure accident, because the whole weight of the ship was grinding on that one part. And that the friction was *enormous* is proved by what Sir John Hay told us, that even with the great depth of water over it, he saw clouds of smoke coming up. The heat there was very great. The wood was charred, and pressed out in a most extraordinary manner. This is my explanation, and I think it is a valid one, of the cause of the "Northumberland" not launching. It was the simple accident of supporting the ways on the sill. If they had not been thus supported, I believe the ship would have gone off satisfactorily. Yet that greater declivity might have been given, I will now show. This slip-way was only built as far as the sill while the ship was building; the part outside was left until the time for launching. The perhaps too frequent change of Officers in connection with the Company induced the mishap; for it appears that the Officers last in charge of the works were not fully cognizant of what had taken place previously, nor with the general plan of this slip-way; as they made the launching-ways, outside the dock, on the top of the mud-bank, which it was intended to remove, therefore they practically diminished the declivity of the slip-way. Now if that mud-bank had been excavated as intended, it would have been very easy to have given a declivity of three-fourths of an inch to the foot.

Sir **John Hay**: I am sure we are all very much obliged to Mr. Henwood for the further explanation he has given us. I have no doubt he is quite accurate in the statement he has made. He is much more capable of giving that information than I am; and probably he would be right in the view he has taken. Perhaps Mr. Luke would say whether that is his view, because he is a very practical man, and would know.

Mr. **Luke**: I would prefer to leave this question to Mr. Lungley, who is now present, and who was manager of the work at the time. It is a question I would rather not give an opinion upon, beyond stating that I do not agree with Mr. Henwood that what he stated was the sole cause of the stoppage.

Mr. **Henwood**: I did not mean to say the sole cause in the sense that there might not have been some minor impediment.

Mr. **Luke**: I beg your pardon; I understood you to say that was the sole cause. It might have helped it, but I do not think it was the sole cause.

Mr. **Henwood**: The principal cause.

Mr. **Luke**: I do not even agree with you there, that it was the principal cause.

Mr. **Henwood**: Will you tell us what was the cause?

Mr. **Luke**: I will reserve giving an opinion until after Mr. Lungley, who was responsible for the launch. My duty began after the "Northumberland" stopped.

Mr. **Lungley**: I think Mr. Henwood is so far right—at any rate, to a certain extent—that there was a rigid part at the end of the ship; that is what I call a trap. From what I gather from Mr. Henwood, he laid the slip in a certain way, and made every calculation to ensure safety, but that he made what we call a dam at the outer end of the slip to form a semi-dock, and made that part very rigid. Of course, the ship settled down on the ways; but when passing over this rigid part she could not settle down equally. There is no doubt but that unequalness was the cause. If the dam had not been there, that is, if the slip had been made in the usual and ordinary way, the part on which the ship was built being all rigid alike, the "Northumberland" would have gone off the first day as well as the last. The "Northumberland," when she did launch, launched herself. Sir John Hay will give me credit for saying at the time, "When the ship goes she must launch herself. Whatever power may be put to launch her, when the ship goes she will launch herself." The obstruction caused by this dam extended to about 6 feet in the length of ways, and formed a complete wedge on the surface, so that the ship would have, as it were, to run up hill. If we had seen this obstruction at the time, that is, the day after the ship had stopped, she would have gone the next day. There was no difficulty in launching the ship save and except this obstruction caused by the sinking of the slip before the ship came over the rigid part in way of dam, made as Mr. Henwood states. He says he drove five and three piles, and instead of making the whole equal all through, he made it unequal by the dam, and that was the trap. If he had made the slip equal it would have settled down equally, and the ship would have gone off the first day. In laying the launching-ways, we lay it with what we call a camber, that is, arched upwards in the length of the ship about 5 inches, to allow for a settlement, so that there may be no chance of the ship settling the ways down to make a hollow line on top, and thus reduce the incline of ways. As soon as we removed the obstruction, that is, took away the part forming the wedge (I may say, I do not know if this was brought to to the notice of Mr. Luke), and as we had now overcome the difficulty, I said, now the great difficulty we shall have will be to hold the ship when we determine to launch her. Seeing that the ship was half launched, and half-way out of the slip, there would come the difficulty of the dog-shores, as we were obliged to get rid of the dog-shores about an hour and a half before high water, and as soon as the dog-shores were gone, the ship began to move. The hydraulics were of no use; no hawsers, nor any other assistance, were required. There was nothing but to hold the ship with the chains and side shores, until the tide ceased running up, and then let her go. I believe the sole reason—I speak candidly—of the ship's stopping was the unequalness of the foundation of the slip.

Sir **Edward Belcher**: Did the tide rise as high that day as it should have risen? And did you not have a much higher tide on the day when she was launched?

Mr. **Lungley**: That had nothing to do with it in my mind.

Sir **Edward Belcher**: But was that the fact?

Mr. **Lungley**: I had a great amount of trouble at the time. I do not recollect if the tide rose higher on the day she was launched or not. I do not think that would have made any difference. We had spring tides on each day when we tried to launch her, and there was not much difference. The ship lifted the next day after she stopped, and on each day of the spring sides afterwards, and we could not account for the stoppage until we discovered the hump under the way; it is now established that she was hanging on this hump.

Mr. **Luke**: One or two observations I will now add. At the upper part of the ways, inside the dam or groundway, to which Mr. Henwood has alluded, there was an almost total absence of grease when we raised the bilge-ways from the sliding-planks, to re-grease; and, in my opinion, that was the principal cause of the stoppage of the "Northumberland." The grease was so squeezed out and melted, that the two surfaces of the wood came almost into a state of cohesion. This absence of grease at the upper part of the ways was, therefore, not caused by the bilgeways passing over the unyielding part referred to by Mr. Henwood. Before successfully launching the ship, we separated the two surfaces of the ways, and put in fresh grease, when we had an opportunity of seeing that the original grease was gone. From the inspection of the ways I made after the ship was launched, I believe that the cause Mr. Henwood mentioned partly contributed to the stoppage, as well as the great pressure of water against her after-body as she descended, laden with so many armour-plates, and drawing so much water. Those two causes, in my opinion, also contributed to the stoppage of the ship, but the want of grease was the principal cause.

Sir **John Hay**: I believe there is very little for me to reply to. I am sure the additional information which has been given by Mr. Henwood, by Mr. Lungley, and by Mr. Luke, will elucidate the facts which I have endeavoured to record here. But I do not think that any of the gentlemen have mentioned that which I think Mr. Henwood, who takes to himself the credit or the blame, whichever it may be, of the general construction of the ways, has not alluded to, that it was not contemplated to launch the ship with her armour-plates on. [Mr. **Henwood**: Oh, yes.] I would merely mention that, because I believe it was not contemplated at first. The weight was very much greater than was originally contemplated. That was the information I received at the Admiralty. The first intention was to launch the ship *without* the plates. 1,700 tons more were set in motion than the Admiralty contemplated. Mr. Henwood may have looked forward to that; but the contractors did not contract to launch the ship with the plates on. Therefore, there is a certain amount of excuse, if excuse were needed, in expecting the ways to bear so much greater weight than had ever been contemplated.

Mr. HENWOOD: It was contemplated to put the whole of the armour-plating on before launching, although not *required* to do so by the contract.

Sir J. HAY: Of course, if the ways were intended to carry them, the other reason which has been stated with regard to the over-strengthening of the dam, would show where the break had been applied, and would check the way of the ship. I think we are all agreed upon that. I shall not detain the meeting further on this point, which gentlemen have explained who are more practically acquainted with the subject than I am. With regard to the peas, to which my hon. and gallant friend has referred, I certainly did not record that with any view of throwing ridicule on the proposal, nor did I mention any names. He was certainly one of the 450 who wrote to me. All the letters were replied to. I am aware that peas have great power. We all of us are aware, when the surgeon wishes to open the skull of an animal, that he fills it with peas, and immerses it in water, and the swelling power of the peas opens, in the most insidious manner, every joint in the structure. Of course, that might possibly be applied on a larger scale. But I do not think my hon. and gallant friend in his letter gave us information as to the cylindrical mode of application which he has alluded to to-day. I merely mentioned the proposal to illustrate the vast variety of suggestions that we received. I did not, perhaps, give to it the attention that it merited.

The CHAIRMAN: I am sure that you will all join me in saying that we are very much obliged to Sir John Hay for this most interesting description that he has given. We are also very much obliged to those gentlemen who have contributed to the information that has been given us on the subject, so that we have come to a pretty clear understanding of the whole subject. I quite agree with Captain Dawson as to the advisability of our having discussions on these particular points, to serve as standard information for the young executives of our service. It is a difficult thing to carry out his suggestion to print and publish all that comes under the observation or within the experience of Officers in the Service, because we must remember that that can only be done by the authority of the Admiralty. The Officer could not do it himself while he is in the service, otherwise there is a good deal of information to be got from the executives of the service upon many points analogous to the present one, or to that which Captain Dawson mentioned of getting off the "Gorgon," which would be standard information for carrying on such services under difficult circumstances. As I said before, this must be done by permission of the Admiralty, at least as long as the Officer is on full pay. We all of us unite in thanking Sir John Hay very heartily for his paper.

PHOTOGRAPHY APPLIED TO MILITARY SCIENCE.

By Lieut.-Colonel J. BAILLIE, H.M. Bengal Staff Corps.

THERE have been few adaptations of this beautiful art to military purposes, beyond that of copying, enlarging, and reducing maps and plans; but the French Exposition of 1867 brought forward some new applications, which should not be passed unnoticed, as they are calculated to be of great value to military men.

First, as applied to surveying, we have the ingenious method of surveying by photography, invented by M. Auguste Chevalier, and, as it does not appear to have been noticed in this Institution, I will briefly describe it. The method consists in taking small circular pictures, or panoramas, round each station of the triangulation into which the survey is divided. These panoramas are printed by the ordinary photographic method, and are cut out and fastened on a sheet of drawing paper in the relative position to each other which they occupied on the ground to be surveyed; and straight lines or radii being produced from the centre of each through the objects shown in them, give by their intersections the relative position of each object on the paper, so that the "filling in," as it is technically termed, is completed as rapidly as these intersections can be found. The diagram (Fig. 1, pl. xxv) explains the process, and I need hardly point out to you the advantages it possesses over the old method of surveying with the plane-table, the prismatic compass, or even the theodolite, since it dispenses with the slow process of observing each object separately, and the liability to any possible error in recording the observation in the field-book, which is now quite dispensed with.

The camera employed is shown, in Fig. 2. It consists of a cylindrical box (which need not be larger than the prismatic compass), which contains a circular plate of glass, which is covered with the sensitized collodion film, as in the ordinary process of photography; the cover of the box revolves loosely on it, and carries the lens, which is combined with a prism, so as to produce a horizontal picture on the glass, of any object in front of the lens: as the top of the box and the lens are made to revolve round its vertical axis, a continuous picture or panorama is produced on the glass below, and of course retained by the sensitive film. The glass is removed, developed, fixed, and printed on paper by the ordinary photographic method, and the picture, as I said before, transferred to the drawing-paper in its proper position. One great advantage of this method is, that as the pictures accompany the plan, the General Officer, for whose information it is intended, has these panoramas of the country actually before his eyes, and can thus form an infinitely better idea of the ground, than can be conveyed to him by any other system of delineation, however careful or accurate; and another is that very little drawing or filling in is really necessary, as the pictures supply all the minor details, and all that is necessary, is to show the intersections of the principal objects. Of course the use of this method would be to a certain extent limited by the small size of the objects shown in the panoramas, and we must still have recourse to the ordinary method of making grand geodetical surveys, when the sides of the triangles are sometimes a hundred miles in length; but for a reconnaissance of an intended field of battle, or of a fortified position, even occupied by the enemy, this method will be invaluable. Two mounted Officers, furnished with these cameras, might gallop up from a given point, such as a tree or a bush (Fig. 5), counting the paces of their horses, and diverging from each other as they advanced, to the front of a position even within range of an enemy's guns, and take each a panoramic view and be off again before his fire could open on them; and as they would know their distance from the point from which they started, which would be also shown in both panoramas, they would bring back with them all the information necessary for a complete plan of the position and the country for miles round it: this could afterwards be plotted out in even less time than its survey

Fig. 1

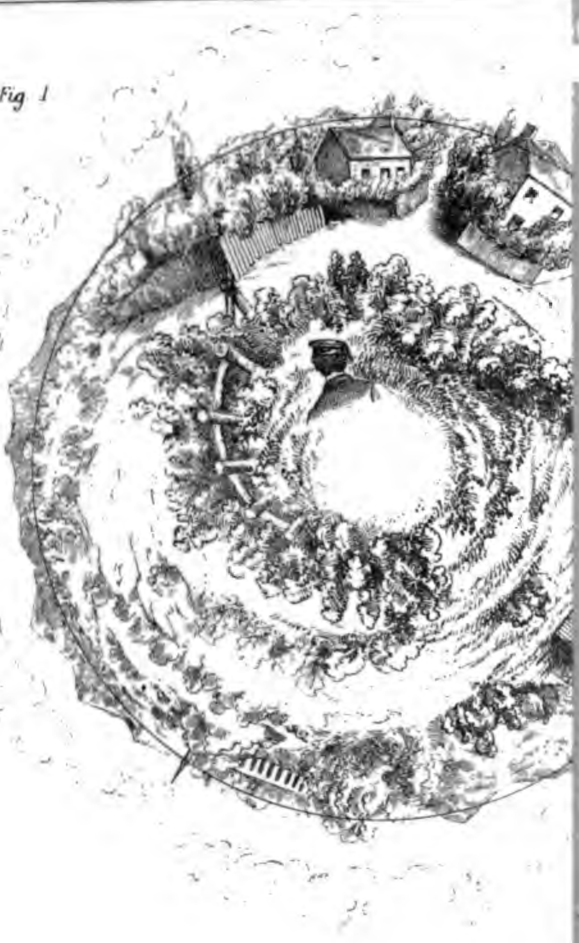


Fig 5.

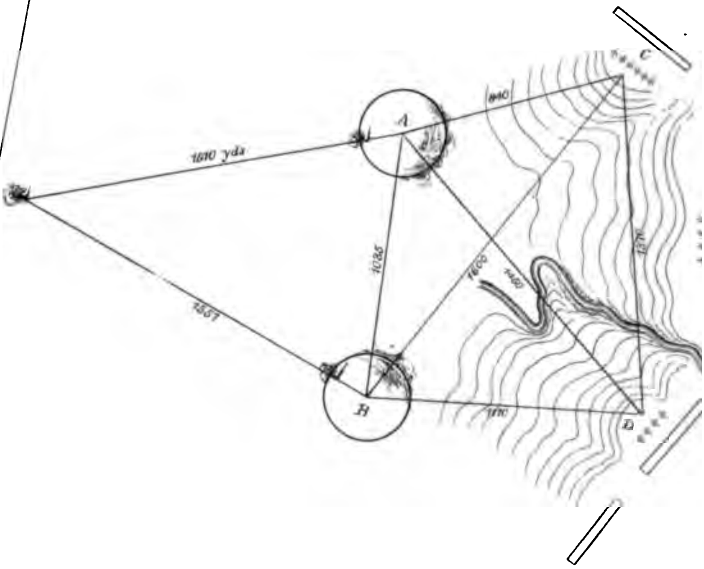
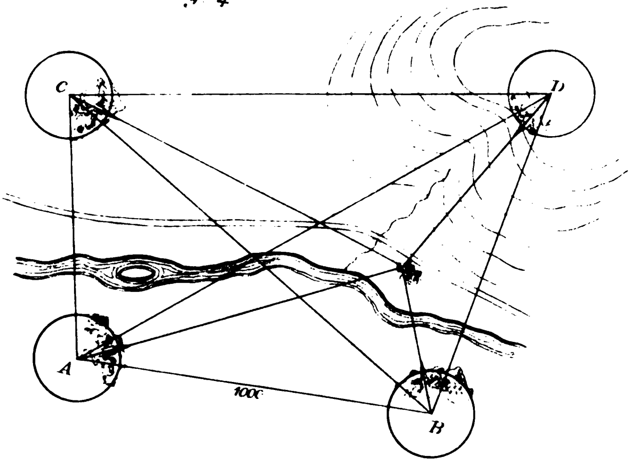


Fig. 4



J. Jobb

required. Again, by turning the instrument over on one side, so as to make the lens revolve in a vertical plane, and putting a white mark or object on the ground immediately under it, it can be used just as easily for taking altitudes and depressions for levelling, so that it is in fact a self-recording altazimuth instrument. I need hardly tell you that such an instrument is calculated to make a complete revolution in surveying, and I hope ere long to see it largely used in our Service. That it has succeeded completely, I can myself bear witness, as I saw in the Exposition a large plan of the Chateâu of Pierrefonds and the surrounding country, produced entirely by this method, and I have here a survey of the plain of Longchamps, near Paris, produced by the same means, which I have compared with plans surveyed in the old way, and I can answer for its correctness.

Photography applied to Map Drawing or Topography.

In the French Exposition there were exhibited some good specimens of photographs from relief-maps and models; among others, a map of France by M. J. L. Sanis, a copy of which is before you: the original model from which it is taken was also shown. I also obtained in Paris some photographs from models produced by M. Bardin, who devoted much time and labour to topography, and who, I regret to see, is recently dead. His process of modelling was one that I had the honour of suggesting in a lecture at this Institution some years ago. After making a careful survey and contoured plan of the ground to be modelled, he traced out each contour on a sheet of cardboard, and having cut it out carefully, he built each contour up in its proper position, so as to produce a solid model. From this he took moulds in plaster of Paris, and from these, casts in the same material, and from these again he took photographs, some of which I have here, and which are very beautiful. If you close one eye, and look at them you will be surprised to see the wonderful illusion of solidity and relief that they afford. You will observe that some of these photographs show the edges of the cardboard, so as to give each separate contour, while others have only the smooth rounded surface; he obtained this very simply, by dusting over his casts with fine impalpable powder, so as to fill up the steps, as it were, between each contour, and reproduce the actual slopes of the ground. The other maps I have here are by Raaz, of Berlin, produced by photo-lithography from models. This, of Palestine, gives the effect of relief very beautifully. All these maps are produced from actual models, previously prepared from surveys, except perhaps this, of Asia, where a good deal of the central portion in Thibet and Chinese Tartary has, perhaps, never even been visited by a European, and must be considered to be "evolved" from the imagination of Humboldt; it may not however be less valuable on that account. However, it is not so much the maps, as the process of producing them, to which I wish to draw your attention, and it seems to me that we have here a method of producing maps and plans by the aid of photography, which will supersede in rapidity of execution all the elaborate systems of "hill drawing" and "scales of shade" upon which military engineers have lately been spending a large amount of time and discussion, with, I fear, very little useful or practical result. The great end and aim of all topographical drawing must be, in my opinion, to produce to the eye, as nearly as possible, what we may conceive to be the actual appearance of the surface of the earth as seen from a considerable distance above it; but a certain amount of conventional drawing must always be introduced into these representations, because we require from a map more information than the earth's surface would give us, even if we could view it in this way. Setting aside the names of places, which could only be seen, perhaps, near some of the railway stations, we should scarcely be able to make out the outlines of the great continents and islands into which our globe is divided by the ocean, because water is very little less transparent than air, and at great distances—such as that of the moon from the earth—we really see through the ocean to the deepest recesses of its bed, and the only evidence of its existence on the earth's surface would be a slight deepening of the tint of the earth, like that produced by looking at an object through a thick pane of glass. Rivers, in the same way, which are merely the intersection of two opposite planes of watershed or drainage would also be invisible. Mountains, again, would only be visible when their ridges and ranges were brightly illuminated on one side, while the other was left in deep shade; and this you may observe for yourselves by examining the moon's surface in its different phases with a telescope. When the light falls directly on its surface at full moon, the mountain ranges are scarcely traceable, though, with an oblique light, they come out with great beauty, as you may see in some of Delarue's photographs and Naysmith's drawings of the remarkable volcanic craters on it. Still, a photograph of any relief or solid will always give us a much better idea of it than any drawing, however carefully it may be made, because it reproduces the illusion of actual solidity and relief, and requires no previous education of the eye to enable us to appreciate it: and for the same reason a photograph of a statue, or a bas-relief, or a building, will always be preferred to the most elaborate drawing of it an artist or an architect can produce. Now, I think photography can do for us in topography quite as much as it has done for sculpture and architecture, and I propose that, in future, when we want a map or plan properly shaded, we should reverse the usual process, and model it first in wet sand from our survey, and photograph it afterwards.

Mr. Galton, in a paper read before the Royal Geographical Society, and published in the thirty-fifth volume of its Journal, has shown how easily this can be done from ordinary models in plaster of Paris, and other materials, and there could be no difficulty in doing the same thing in the field from the sand model. A cart-load or two of sand, and a tripod scaffolding, built up of scaling-ladders to carry the camera, would be all that we need, and there are some excellent modellers already in the Royal Engineers, as the Museum of this Institution can bear witness. The construction of the model may be greatly expedited in practice by simple mechanical expedients: for instance, buildings may be represented by pieces of cork simply laid on the sand in their proper positions; walls and fences by slips of cork or cardboard inserted in the sand; hedges by similar slips edged with a little moss glued to them; trees and bushes by lumps of moss, or Berlin wool pulled out; the rails on a railway by slips of blackened cardboard; telegraph lines by needles, with a fine thread run through them and stretched, and lines of sections, &c., by threads stretched across the model; ditches and roads and railway cuttings may be scooped out by slips of tin bent to the required section, and even the furrows in fields may be shown by slips of tin, with saw edges at different intervals, so as to show the varying natures of the crops. Numerous similar expedients will readily occur to an expert modeller, to be applied as the nature of the country and the scale of the model may demand. The same process would be applicable to plans of fortification and other military works, both of attack and defence. There is no reason, too, why the same process should not be adopted in our ordnance survey. The hill drawing of some of the earlier sheets of this, on the one-inch scale, is very poor, no better than might be expected from their date, when the art was in what we might style the early "caterpillar" period, and they should be redrawn on the six-inch or twenty-five inch scale, and reduced by photo-lithography, and transferred to stone at once. Steel and copperplate engraving is too slow a process in the present day, and even with the aid of the electrotype process of multiplying duplicate plates, these soon deteriorate, while we have to wait years for a single sheet, as in the Indian trigonometrical survey. By substituting photo-lithography from the model, we can dispense with both the draughtsman and the engraver, and we should obviate all difficulties as to scales of shade; whilst by printing our maps in different colours we should be able to give much more information in them without confusion, and they would be greatly improved in appearance.

Photography in the Field and under Fire.

I have shown in the first part of this paper how it is possible to make a survey of an enemy's position, even under fire, by the aid of photography; but this plan involves certain conditions, which can only rarely be secured. It could not be carried out, for instance, if the enemy covered his line with advanced videttes of Cavalry or picquets of Infantry, as he ought to do, when not liable to momentary attack, so that, to obtain a photograph of his works it might be necessary that the videttes and picquets should be driven in, which we could generally do with an inferior force, or sufficiently so to enable us to get a good view of his lines. The photographic party must accompany our skirmishers, and get well in front, so as to have a good view; it therefore becomes a question as to what kind of camera could be used for the purpose. The grand photographic van that was constructed for the Crimea, a kind of hybrid affair, between an ambulance and a bathingmachine, would be manifestly useless. And even if we left this in rear, there is still the camera and its stand and supply of plates to be carried, and it ought to be able to accompany the Artillery. I have therefore come to the conclusion that we cannot find a better model for the apparatus than a light galloper-gun and limber, with a well-trained squad of real gunners to take the photographs. A gun-carriage is as firm and portable a stand for a camera or anything else as we can possibly produce, and the elevating screw would enable us to point it as quickly as a gun. The limber-boxes would contain any number of charges of prepared plates, each in a separate box, and, with cool, steady fellows like our Artillerymen, the camera could take a picture for every shot from the gun beside it. I would go further and make the camera as nearly like an Armstrong gun in appearance as I could, so that it might take up its position with the guns, say on their windward flank, so as to be taken for one of them, and thereby attract less attention. It may seem puerile to some of you to propose a photographic gun-drill, but there is a considerable similarity in the processes and also in the principle involved, which is simply the division of labour; and there is nothing really more ridiculous in drilling men to take photographs than in drilling them to cram powder and shot into a tube as quick as they possibly can, and apply a light to it. We do not, in ordinary shooting at birds or hares, go through all the motions of the manual and platoon exercise, but if we want to fire twenty rounds in a minute, or to get 1,000 men to fire a volley together, we know that the manual and platoon is the best and the only mode by which we can effect it. I feel quite sure that it is very much easier to teach Artillerymen the mechanical processes of photography than to give the photographers the nerve and coolness under fire that our Artillerymen possess. And, after all, the only non-mechanical part of the photographic process is the focussing and timing the exposure, and the last is simplified by using one of the instantaneous processes. These photographs need not be again printed on paper, unless it were desirable to retain copies of them for record. On the contrary, it would be sufficient to use what is called a positive process, which, when backed by black varnish, gives a picture distinct enough for all ordinary purposes. The process must be simple and inexpensive, as it is extensively used in the east end of London in establishments where you are offered "a clean shave and your portrait for threepence." A Commander-in-Chief having several of these cameras at his disposition, would literally have his eyes everywhere. He could be supplied with these optical reports from each division of his Army as fast as orderlies could carry them, and I believe it would be possible for him to remedy with them the defects of his own short-sightedness. I have said the camera should be constructed to imitate a gun, and I believe it is quite possible to convert the long tube into a telescope, and so to obtain pictures at a range quite equal to that of the gun itself. I must leave it to photographers to say how far the loss of light in a greatly enlarged picture might weaken its impression on the sensitive plate, but I have no doubt they could easily supply us a "*process*" suited to the purpose, and, in the meantime, we may recollect, that any photograph, carefully focussed, will bear very considerable enlargement in the magic lantern, and the details even of the extreme distance, will be faithfully reproduced, though so small as only to be visible with the microscope.

I fear your patience must be nearly exhausted with this prolific subject of photography, but there is still another application of it which I do not like to leave unnoticed, because it is one that may be specially useful to yourselves; that is, photography as a substitute for printing or lithography. You have all, I daresay, felt the want of a simple printing or lithographic press by which you could yourselves produce twenty or thirty copies of a circular, a programme, a bill of fare, your latest poetical effusion, if you are given to poetry, and fifty other things of the same kind. The same want is felt in the Army, whether in the field or in quarters. There is every day a crop of orders and memos to be written and copied, and published by or to each individual in it. We begin in the morning with general or division orders, and these are filtered down all day through brigade and regimental and company orders, and through various ramifications in memos to Adjutants and Quartermasters, and Surgeons and Commissariat Officers, and *id genus omne;* all more or less require to be copied; consequently in the field a large proportion of the camp followers are the clerks, whose special duty it is to perform this copying and distributing process. In the field this is specially objectionable, for these clerks are sometimes leaky vessels, and mistakes happen—important information miscarries. In India this has frequently happened, and I recollect, in the first Sikh campaign, a native writer in one of the head-quarter offices was detected in one of these mistakes, and quietly sent home, instead of being hanged. However, such is the system, and bad enough it is, for want of a simple copying-press.

Now photography again steps in to supply this want, and I think if you try the plan you will find it does so efficiently. Take a common frame with a glass in it, like the transparent slates that children use for tracing on, but with a bit of polished glass, though the ground glass would do on emergency; daub this well over with a mixture of wax and lampblack till you cannot see light through the glass. Then with a needle fixed in a light handle write your letter, or make your sketch on the glass, taking care to remove the wax clear and clean at each stroke. Now slip into the frame a bit of paper, prepared in the ordinary way for printing photographs, by soaking first in the salt and water and then in dilute nitrate of silver,* and replacing the back, put the frame out in the sun for a few minutes; then take out the paper, dip it in a solution of hyposulphite of soda,† to fix it, and wash and dry it. The process takes longer to write than it does to put in practice, and though nitrate of silver and hyposulphite solutions have a fine chemical tone about them, they are not a bit more difficult to use than the solution of sulphate of iron and nut-galls, which composes common writing-ink. A Staff Officer might take a dozen of these frames in a box beside him; and they may be printed by a man or boy who cannot read. The paper, of course, must be prepared at night, or in a dark room or tent, and should be kept in the dark till used. There is nothing very novel or original in this copying process; it is simply a combination of the old classic method of writing on wax tablets with a style, with photography, and it is the converse of the first step in photography by which some fifty years ago copies of lace, feathers, leaves, &c., were printed by it. The only objection to it is, that we cannot print on both sides of the paper, but this I think is common to all copying processes that I am acquainted with. By leaving out the lamp-black in the wax ground and using a thicker coat of wax, only, say one-eighth to one-quarter of an inch, a clever draughtsman can produce very beautiful pictures by this process with great rapidity. The greater or less thickness of the layer of wax left on the plate produces in printing very soft and delicate gradations of light and shade, similar in effect to the Berlin porcelain picture screens. This leads me to another application of this process of printing, which I may mention here, though it is not strictly a military one. Many of you are probably aware of the difficulty of representing certain statistical facts and details pictorially. For instance, suppose you desired to represent on a map of England or of London the density of population, or in an educational return the number of persons who cannot read and write, which I may call the density of ignorance over a given area; or in meteorology, the annual rain-fall; or in hydrography, the varying depth of water in a channel; or, indeed, for any other purpose where a graduated tint is to be produced, the only method I know of hitherto is a system of cross-hatching by ruled lines, the accuracy of which must depend entirely on the skill of the engraver you employ. This process enables you to produce the required result yourself in a purely mechanical way, by simply scraping away the wax so as to leave a very thin coating only, where the greatest depth of tint is required, and I believe there is no other mode of printing that will do it so accurately or rapidly, and I think it might be adopted with advantage by the Registrar-General, and for many of our Parliamentary returns and reports.

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* Nitrate of silver 60 grains to 1 ounce distilled water.

† Hyposulphite of soda 6 ounces to 30 ounces of water.

I will return for a few minutes to its application as a substitute for printing. It is not necessary that copies should always be produced from the tablets on paper in order to make them public; they can be read at once by holding them up before the light, and if we wish to publish them to fifty, or a hundred, or a hundred thousand persons at a time, we could do it just as easily by putting them into a magic lantern, which is only a camera-obscura inverted, and exhibiting them on a large screen of cloth, or a blind in a window, or on a whitewashed wall or other large white surface, so that "he may read who runs," if he can. It would not be always desirable to publish our orders to the whole Army at once in this way, but it might be useful sometimes to issue a proclamation or notification to a great number of persons, and with one of Captain Bolton's signal lamps it would be quite practicable not only to enlarge the writing sufficiently for this purpose but to throw the image to a very considerable distance, and there are many cases where signals and messages could be conveyed more rapidly at night by this means than by the process of spelling out each word by a combination of flashes. One use of it occurs to me at once, that of showing the names of our lighthouses along the coast at intervals, so as to prevent the fatal accidents that frequently occur from their being mistaken. Another might be conveying instructions to ships coming into harbour, or even manœuvring at sea. But I am already wandering far away from photography, I will therefore conclude, trusting that I have said enough to show you that military science, like any other branch of science and art, will benefit very largely by the assistance of the wonderful and beautiful art of photography.

The **Chairman**: Would any gentleman like to ask any question upon the subject?

Sir **William Codrington**: The difficulty with regard to issuing orders in an army I fancy arises from having to carry the type. Therefore, if this means of scratching away wax on a plate and exposing it to the light should be available, of course it would prevent that necessity. Does it require the sun to make the impression from that?

Colonel **Baillie**: No; only a strong light.

Sir W. **Codrington**: The paper must be freshly sensitized, or is there any difficulty in carrying it so sensitized?

Colonel **Baillie**: The paper can be kept about a week. Beyond that period it is rather apt to deteriorate. It is desirable that it should be prepared every night.

Sir W. **Codrington**: Are the stores for wetting it and preparing it simple?

Colonel **Baillie**: Extremely simple. Nothing more than a solution of common salt and distilled water is the first process. On that the sensitive solution is applied, ammonia and nitrate of silver. I have not entered into the details, because Mr. Pritchard,* in a lecture delivered in this Institution about ten days ago, entered into the whole process, and he explained it so satisfactorily that I do not think it necessary to add any more upon the mere technical process of photography.

Sir W. **Codrington**: As I understand, no printing is actually required?

Colonel **Baillie**: No printing from type.

Sir W. **Codrington**: And no printing from what is called the carbon-process?

Colonel **Baillie**: Nothing. Simply the light passing through the glass leaves the picture.

Sir W. **Codrington**: For each order you would require a plate to be exposed, then how long would it take to give 100 orders? that is the point.

Colonel **Baillie**: Photographic printing of that kind is really now instantaneous. The moment the sun's light touches it, the print is there. It takes a little time to develope afterwards, when it is put into the solution; but it is instantaneous to all intents and purposes.

Sir W. **Codrington**: Then there is the solution besides?

Colonel **Baillie**: That is to remove the nitrate of silver afterwards, to prevent the picture fading. After the picture is taken out of the frame it is thrown into a large basin of hyposulphite of soda solution, which is the washing process, as it is called. It is allowed to soak there for twenty minutes or half an hour, to prevent its fading. But that would not be necessary with this process, because the orders are not supposed to be kept longer than a day or two.

Colonel **Hume**: If any orders were required at night, you would have to use a strong light?

Colonel **Baillie**: Yes; the magnesium light would do.

Colonel **Alcock**: Would Colonel Baillie explain the process of taking a panoramic view?

Colonel **Baillie**: The glass is placed in the bottom of the instrument. It takes the place of the compass card in our surveying compass—the instrument is very much in that style. The glass is previously prepared by any sensitive process; what we call the dry-plate process, which takes a picture almost instantaneously, is perhaps best suited for it.

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* See "Journal," vol. xiii. p. 419.

Colonel Alcock: Does it take the whole circle?

Colonel Baillie: The whole circle, as fast as you can pass it round. We have processes now in photography which will take objects instantaneously. We had pictures exhibited here the other day of birds on the wing.

Colonel Alcock: How much of the circle is taken at one time?

Colonel Baillie: Only the portion immediately under the prism is taken at one moment, but we take the whole circle, because it is not worth while to take portions of the circle. Where you have the plate sensitive all over, it is better to take the whole circle at once. Fig. 1 represents a sketch of the panorama after it is produced, when it is taken out and printed on the paper. Supposing this (pointing) to be the centre of the picture, the panorama is represented all round the circle. The circle represents the horizon line, and by drawing lines from the centre through the horizon line to any object, a steeple here, the top of a hill there, the corner of a house there, we have the whole of the angles all round the station. These are panoramas (Fig 4) A, B, C, D, cut out and pasted down on the paper. Of course it would be necessary to measure one side, such as A, B, for you are aware we must have a base in any survey to give us a scale, and from that, as I said, we might produce the whole of the survey. Two Officers take up their position in front of a position (Fig. 5). They take one point such as the tree, so as to complete the triangle; then, with their distances from the tree they are able to calculate their distance from each other, which is the base, A B. Having secured their panorama at each end of it, on their return they are able to calculate the separate distances, A D, C B, and C D, from this. This figure (Fig 3) shows the application of the instrument to taking vertical angles. In this case the instrument is turned down on one side on its ball and socket joint. The box becomes vertical and the tube horizontal. Then, as it is turned over, the whole of this picture (Fig. 3) would be taken instead of that one (Fig. 1). For instance, here would be the horizon, A, B. Then, as the instrument travels downwards to C, this (D) would represent the station, or any white object placed underneath the box as a mark. Again, as we travel round, we show the elevation of another portion of the horizon, B. Then, as we pass on, we come to the clouds above, which are shown as they would be seen directly from underneath. Again, we come to the sun, or any other object sufficiently powerful to print itself, the moon even, and we should have its actual altitude above the horizon from this point.

Sir W. Codrington: I do not quite understand. If this instrument is placed, say at A in Fig. 4, it reflects what is seen in front. How does it take a plan?

Colonel Baillie: It takes bearings of objects all round the circle, just like the compass or theodolite. A represents a station of the Officer or observer.

Sir W. Codrington: Still only what is seen before him is represented?

Colonel Baillie: What is seen before him and round him as the top is moved round. The centre of the picture will be left entirely blank.

Colonel Yorke: M. Chevallier's instrument revolves, does it not?

Colonel Baillie: Yes, it revolves. The top of the box is not shown in this figure (Fig. 2), but it revolves round the circle, round the vertical axis of the instrument, A B.

The Chairman: It revolves round over the sensitive plate?

Colonel Baillie: Yes; it revolves round over the sensitive plate.

Colonel Yorke: Under the vertical part of the camera there is a slit?

Colonel Baillie: Yes, a narrow slit or diaphragm, to confine the action of the light.

Colonel Yorke: The upper plate which carries the tube revolves round the lower plate, and you thus get an annular picture.

Colonel Baillie: Precisely.

Colonel Yorke: M. Chevallier speaks, I think, of a clockwork motion?

Colonel Baillie: Yes; he adapted a complicated clockwork motion to it, but it is not necessary to its action. He was not acquainted with any instantaneous process. This instrument was invented in 1859, but it was only brought forward at the Exposition of 1867. At that time he does not appear to have been acquainted with any sufficiently instantaneous process. In fact, there are not many that can be actually practised in England. In France they have a better climate and a clearer sky. There was one invented some years ago by Mr. Skaife; he produced what he called a pistol-graph. That was sufficient, where you have anything like a bright sun. In India I have taken with it a horse in motion, and a man lifting up his arm. You see the arm instantaneously arrested. I have not practised photography much in England, and it requires favourable conditions of the sky here to take instantaneous pictures, but although I show the full details here, you are not to suppose that the picture, as taken on that card, would be anything like the photographs that were exhibited here the other day. All we want is a simple outline, and a few distinct points, sufficient to show the prominent objects of our panorama. In the same way we can show the direction of the magnetic meridian. We should put a pocket compass on the box and send out a man to any point in the proper direction near the horizon to hold up a white staff; and when the picture was taken he would be represented in it with the staff, and that staff would be the exact direction of the magnetic meridian. The picture is thrown down by the combination of a prism and lenses to convert the rays from the horizontal to the vertical direction. I regret that I have not got the instrument to show you. I very much doubt whether it has been introduced into this country. When I was in Paris I tried to get one, but they had not commenced to manufacture them. The only one I saw was the one made by M. Chevallier, and exhibited with the plans. Those were exhibited with the actual photographs upon them, so that there can be no question about the practicability of the method.

The CHAIRMAN: The meeting will, I am sure, join me in thanking Colonel Baillie for the information he has given us. It is evidently the beginning of a subject that may be of great use hereafter. I leave military men to judge of that; they will know more about it than we sailors can do. But it is evident there is the foundation for a great deal of use in it.

Evening Meeting.

Monday, June 7th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 31st May and 7th of June, 1869.

LIFE.

Kerr, Lord Walter Talbot, Comm. R.N. 9*l.*

ANNUAL.

Baring, E., Lieut. R.A. 1*l.*
Maurice, J. F., Lieut. R.A. 1*l.*
Carmichael, L. M., Lieut. 5th Lancers. 1*l.*
Colvill, Charles, Lieut. 54th Regt. 1*l.*
May, Charles H., Capt. R.N. 1*l.*
Brownlow, A., Commr. R.N. 1*l.*
Berkeley, F. G., Capt. 47th Regt. 1*l.*
Brown, F. D. M. V.C., Capt. Bengal Staff Corps. 1*l.*

THE REVOLVING SYSTEM OF FIRING GREAT GUNS.

By Commander BENJAMIN SHARPE, R.N.

BEFORE describing *revolving guns*, it may be desirable to glance at some of the present requirements of naval warfare, arising from the gradual increase in the size of the guns employed by different nations, in order that the very serious position in which so many of our best Officers consider our iron-clad fleet to be at present placed, may be brought prominently forward, and the remedy proposed be better appreciated.

In our old and glorious wars, battles were fought and ships were taken without the aid of plating (one of the principal of modern requirements), it being unnecessary, as the vessel's safety was seldom compromised by the shot then employed; for, with the exception of the "Glatton's" 68-pounder carronnades, 32-pounders of 56 cwt. were the largest guns in use, and these were confined to the lower decks of ships of the line, a 24-pounder frigate being considered a heavy frigate. With the introduction, however, of more powerful guns, throwing shot of greater diameters, the very existence of the vessel came into question, as shot holes, from eight to thirteen inches in diameter, will rapidly admit a highly dangerous stream of water, and which during an action would be difficult, if not impossible to exclude. Hence arose the necessity for armour-plating, a necessity in reality confined to those parts of the vessel where the entrance of shot will be followed by water; and had the employment of armour-plating been strictly limited to these parts, instead of being diffused over so wide an area, that a thickness of only 4½ or 5½ inches could be employed, the country would have been spared the useless expenditure of millions on our present fleet of iron-clads, which are merely weighted, but not protected by plating so slight, and which, in the event of a war, will leave them at the mercy of any properly-armed gun-boats; these ships are, indeed, in a worse position than wooden vessels, as shells, after passing through one of their sides, will be retained inboard and explode.

Unfortunately for the country, the temptation to carry the plating sufficiently high to include the guns and their crews, was too great to be resisted, and a serious reduction of the proper thickness of the plating was the necessary consequence. The general weight of the armament had also to be greatly reduced, and the size of the vessel considerably increased: this applies equally to the broadside, turret, and box systems.

As the vessels of our fleet can only support a given weight of plating (barely sufficient for the protection of their wind and water lines), it necessarily follows, that every ton of plating devoted to the exclusive protection of the guns and their crews, as for instance, all that above the deck-beams in the broadside vessel, and on the turrets and boxes, in turret and box-vessels, is so much taken from the security of those vessels. The mistake, indeed, is of a two-fold character, for if 4½ inches of plating is insufficient to keep shot from penetrating the water-line, it will equally be incapable of protecting the guns and their crews; but wherever there are ports, the value of any plating becomes greatly reduced, for besides shot and shell entering them, ports can always be commanded by grape and canister from a few light guns, or by musketry, while the water-line (the true point of attack) is being invaded by both ram and guns.

I am not drawing an imaginary picture. To show the extent of the evil, I hold in my hand descriptive drawings of thirty of our iron-clads, and out of these thirty vessels, no less than twenty-five of them have only a thickness of 4½ inches of plating to prevent shot from sinking them; four have 5½ inches, and one only has 6 inches, all entirely owing to the plating being employed in the protection of the topsides, turrets, and boxes.

The greater part of my audience, from their professional experience, must be aware that such plating can be penetrated without the slightest difficulty, but the general public do not possess the same technical knowledge, or there would be a wide-spread feeling of alarm and dismay at the very serious position in which our fleet is now placed. The impression is, on the contrary, general, that the many millions which have been expended on some of the most singular vessels this world has ever seen, have at least provided these vessels with a metallic covering capable of keeping out shot and shell; but the sooner the fallacy of this is generally known, the better, as we may be caught totally unprepared.

I will, with your permission, read what Mr. Watts, our late Chief Constructor, and Admirals Sir Thomas Hastings and Sir Robert Smart say on the subject, and these are names which will bear the greatest professional weight with the country. I am anxious to do so, as they allude in such favourable terms to the revolving system of fighting great guns, which I am about to bring under your notice, and which I trust will aid us in our present difficulty.

TESTIMONIALS IN FAVOUR OF COMMANDER SHARPE'S REVOLVING GUNS.

From MR. I. WATTS, *late Chief Constructor of the Navy.*

6, Howley-place, Paddington,
October 20, 1868.

My dear Sharpe,

After further consideration of your plan, I have no wish to withdraw what I have said regarding it, or to restrict you in mentioning it to any of your friends if you think it worth while to do so. I have endeavoured as the most friendly act to see what objection I could raise, and can find none.

As regards its application, it appears to me to be admirably adapted for gun-boats. Small vessels comparatively, might carry 4 (say) 7-in. Whitworth guns, capable of penetrating the armour-plating of most of our present ships—if not all.

I have been sketching in a very rough way my notion as to how these guns might be placed, and the character of the vessel, you can, no doubt, make a perfect design if you think fit.

The midship section to be somewhat of the form I have sketched with considerable tumble—home, and admitting in consequence of the armour-plating being considerably reduced in thickness.

A belt of armour about five feet, two and a-half feet above, and two and a-half feet below water, would, I think, be sufficient; above that you might have turn-down bulwarks quite light.

Double or single screws as might be desired.

I think I have given sufficient to indicate the current of my thoughts.

The plan—an unobjectionable one—of devising the smallest gun-boat or vessel, would be regarded of great value, and I do not think you could put forth yours in a more striking manner.

(Signed) I. WATTS.

From ADMIRAL SIR THOMAS HASTINGS, K.C.B., *head of the Naval Gunnery Department and Ordnance for many years.*

7, Seymour-street, W.,
October 23rd, 1868.

My dear Sharpe,

I thank you for the trouble you have been so good as to take in calling on me, for the purpose of explaining your plan for using revolving guns. The proposal is new and daring, I have never seen anything like it, and having thought on it for twenty-four hours, I cannot find out any point to object to, and I shall perhaps sum up my cogitations best by telling you, that had I the power to do so, I would at once order a gun-vessel with a velocity of at least twelve knots an hour to be constructed; in such a vessel an enterprising man might astonish the world by his deeds in war.

I am convinced that it is of the last importance for the maintenance of our superiority at sea, and for the protection of our trade, that we should have a numerous heavily armed flotilla, the first division having the highest velocity which could be given to them, the second and third, perhaps of smaller dimensions and a lessened velocity, corresponding to their diminished tonnage.

All our present style of gun-boats are below the mark, and will be swept away.

The sort of vessel I have pointed out would be indispensable in a war on the Black Sea and the Baltic, and most valuable in the Channel.

Believe me it has given me much pleasure to see an old "Excellent" exercising his talents for the good of the Naval Service, in which I have often lamented that you had not received the reward your zeal and ability deserved.

(Signed) THOMAS HASTINGS.

From ADMIRAL SIR ROBERT SMART, K.C.B., K.H., *late Commander-in-Chief in the Mediterranean.*

Chiswick, February 22, 1869.

My dear Sharpe,

I have received your note, and think myself lucky that I left my gold-headed cane behind me, since it produced your note.

I am glad indeed to have seen your further development of your plan of working heavy guns with a vertical and horizontal motion, and where the guns and men are for the most part under the fighting deck, protected by the increased thickness of plating of the ship's sides, which if thought necessary may be added in proportion to the weight dispensed with from the absence of turrets.

Having seen the remarks on your scheme of arrangement, made by Mr. Watts, late of the shipwright department of the Admiralty, I concur fully in their justness, and believe that for vessels of a moderate depth of hold and speed (a desideratum in our service), your arrangement which would arm them heavily would be all important, and should be tried.

Such ships so armed would be "uncanny" customers for your leviathian armour-clads, if you can thoroughly control the recoil in the first place, and keep the water out in the second, which are heavy and important details.

(Signed) ROBERT SMART.

Mr. Watts, the late Chief Constructor of the Navy and the author of so many magnificent ships, gives, as his opinion, that a 7-inch Whitworth gun carried by a comparatively small vessel, is capable of penetrating the armour-plating of most of our present ships, *if not of all.* Admiral Sir Robert Smart, whose practical experience no one will gainsay, concurs fully in the justness of his remarks, and Admiral Sir Thomas Hastings, one of our highest authorities on these subjects, considers that all our present gun-boats are below the mark, and will be swept away.

Experiments at Shoeburyness on the 4th June (since these remarks were penned) have shown that a 5-inch plate can be perforated by a shot from a 7-inch muzzle-loader Woolwich gun with only 8 lbs. of powder (a less charge by 2 lbs. 11 ozs. than that of the old 32-pounder), the shot passing completely through the plate (rolled some months since by Sir John Brown and Co.).

This is not a satisfactory position for the country, and for our Officers and men, who, if a war were to break out to-morrow, would be placed in the same false position that they were in, in the American War: the same sad lesson bids fair to be repeated.

But a remedy is fortunately open to us. We can by stripping off the plating from the topsides, turrets, and boxes, at once increase the substance of the plating on the wind and water portion of the vessel, and obtain the desired security against being sunk by shot; to resist the ram we must adopt other means, a description of which will be foreign to this paper. By this act we of course deprive the guns and their crews of the special protection they now enjoy. A shot which passes through a topside, turret, or box, however, is not attended with the same perilous results as one passing through the water-line, and the guns and their crews will be in as safe a position as that which satisfied Nelson and our great war captains, indeed far safer, for instead of the iron hail of Trafalgar, the shot will be few and far between, from the guns carried being so greatly reduced in number, and the increased size of the guns will not entail any greater risk to individual life, as a 6-pounder will as effectually kill a man as will a 600-pounder.

So little, however, does the superior claim of the water-line appear to be regarded, that both the "Monarch" and "Captain," two of our latest constructions, have ten inches of iron, besides an inch and a half of iron-skin on their turrets, while their sides are only defended by eight inches; but no sane Officer would think of attacking 11½ inches of iron when eight inches offered greater facilities and a more decisive result. These two vessels have each some 500 tons of dead weight, in the shape of turrets, exclusively devoted to the protection of four guns, which weight in no way contributes to the safety of the vessel. But assuming this latter to be sufficiently provided for, it is a fair question to ask, whether the "Monarch" and "Captain" would not be infinitely more formidable if the 500 tons of turrets were turned into additional guns, and employed as active, instead of passive agents?

If we turn to our Naval records there will be ample evidence of the extreme danger to which a line-of-battle ship was exposed when becalmed within reach of gun-boats.

What then will be the fate of the "Monarch" and "Captain" with (instead of 70 or 80 guns) so very few guns, if attacked only by a number of screw colliers, each armed with a gun capable of penetrating their water-lines? They would be helpless,—more particularly if a herring-net, or a piece of a boat's fall got round their screws.

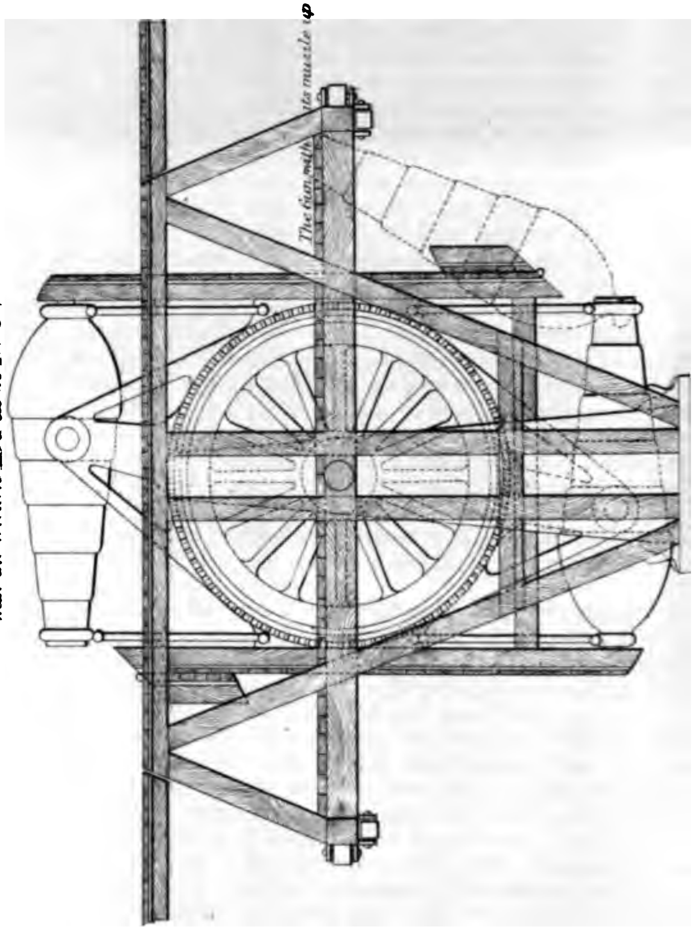
On one point there can be no question; viz., that the "Monarch" and "Captain" are built some 500 tons or more larger than they need otherwise have been, not for working four guns (as the rotary platforms might still be retained), but for affording these guns an imperfect protection 500 per cent. heavier than themselves.

As a drawing of the "Royal Sovereign" in the *Illustrated London News* more particularly drew my attention to the serious evils of the present system, I cannot do better than take this vessel to illustrate my remarks, as she combines both the past and the present, the object attempted, and the cause of its failure.

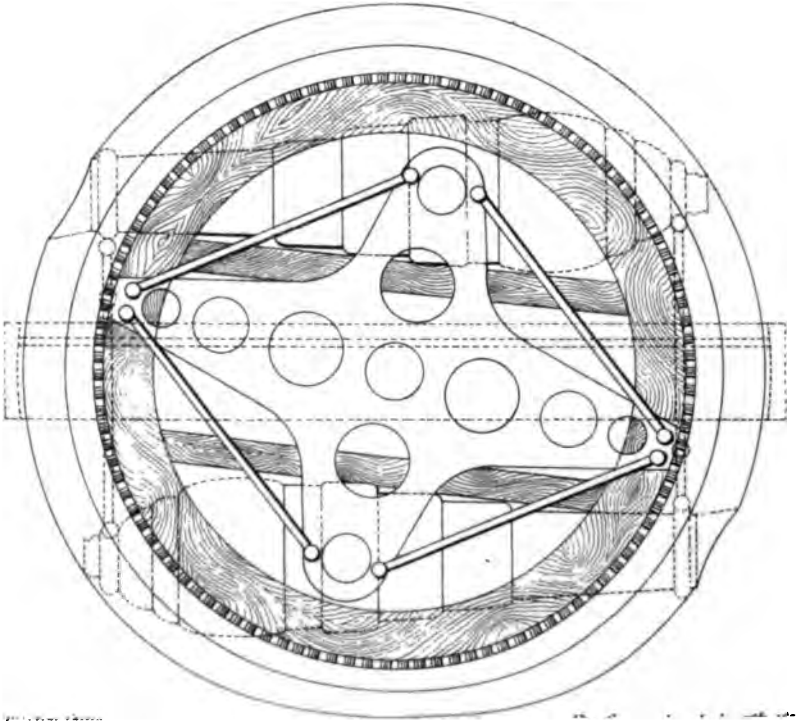
As a wooden three-decker the vessel was thoroughly seaworthy, and mounted some 400 tons of ordnance; but since her conversion into a turret-ship, she has become unsuited for sea service, and as the 5½ inches of plating on her sides can be easily penetrated by shot and shell, she is just as liable to be sunk as before.

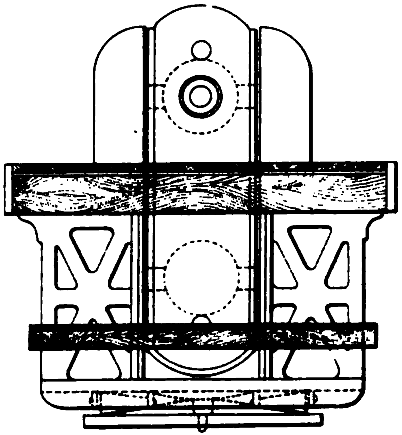
But what, may we ask, has occasioned such a failure? for when a

N° 1
with the friction Axles as in N° 5.



N° 3.

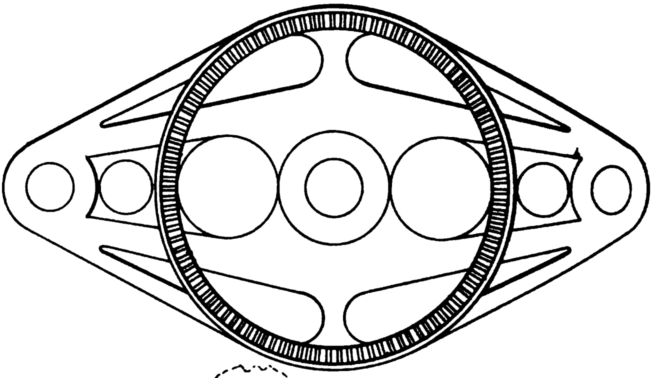




An end-on view of the same on half the Scale.

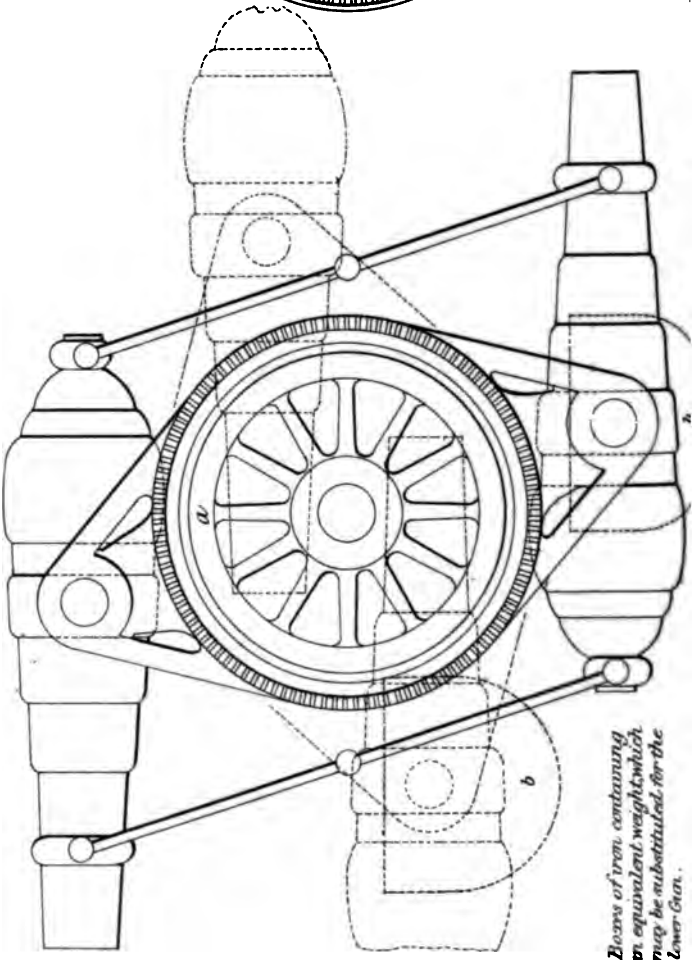
J. Jobbins

N° 4.



Connecting Rods as in No 5

N° 5.



b Boxes of iron containing an equivalent weight which may be substituted for the Lower Gun.

Jobb

vessel has been relieved of so great a weight of ordnance, of decks, masts, yards, and topsides, a different result might have been anticipated.

It is simply this, the four turrets weigh 611 tons, and this enormous weight of metal has been diverted from where it would have insured the vessel's safety, to the infinitely less important object of *protecting* five guns in four turrets, and has left her in her present helpless position with only 5½ inches of plating, and without canvas to aid her should her screw become damaged.

Until a vessel has been secured from foundering, every ton of defensive plating diverted to any other object is doubly suicidal, as in addition to the inroads of shot, we have now to provide for the new agent in warfare, the ram.

The "Royal Sovereign" being a converted vessel, it might be considered unfair to allude to her; but the question is only one of degree. The "Royal Sovereign" requires 611 tons to protect five guns, while the "Monarch" and "Captain" each take above 500 tons (I have not the exact figures) for protecting four guns.

The whole of the plating being required for the wind and water-part of the vessel, if the guns and their crews are to be protected by plating, it can only be done on the "revolving principle," which brings *the guns under cover of the water-line plating for being loaded, and afterwards revolves them into action.*

The "revolving system," which I will now endeavour to describe, is capable of considerable modifications to suit the varied circumstances of both sea and land warfare, but the same principle is to be found in all.

Two similar guns, or a gun and its equivalent weight (Plate xxix, fig. 5), being placed parallel and opposite to each other on the same framework, and equi-distant from a common axis of rotation, must counterbalance each other. This must be kept in view, otherwise it will be difficult to divest the mind of the natural, though erroneous idea, that the gun, while recoiling in a descending arc, will have its momentum accelerated by gravity.

Here may be seen a wheel revolving vertically on an axle, with all its parts equally balanced, so that in whatever position any point in the revolving surface may be momentarily placed, in that position it will remain; and when set in motion the wheel will revolve with equal velocity, whether the power be applied in an upward or downward direction, and the same will be the case with two similar guns placed equi-distant from the axis of rotation, with their centres of gravity connected by a straight line passing through this axis.

Having cleared away any apparent difficulty from the action of gravity, we will next consider the means for controlling the recoil.

There are several modes in which the recoil may be stopped, a description of three of them will show the powerful means at command.

As the most ponderous machinery may be stopped while revolving by the mere application of a friction surface, so the same means may be applied to control revolving guns, by attaching two friction wheels to the brackets, one on each side of the gun; another mode, from its great power and simplicity, will equally commend itself to our attention, as the heaviest recoil may be stopped without occasioning the slightest strain, by merely causing the gun to raise a weight temporarily attached to the framework underneath its muzzle (as shown in the diagram No. 6, Plate xxx); this weight will be considerably less than the force exerted, from the levers D A, or E A being more powerful than the levers B A and C A, the former representing the length of the lever attached to the weight, the latter the length of that on which the explosion of the charge acts.

But whether in theory or in practice, I think it will be admitted that nothing can be simpler or more complete than the recoil being subdued by the mere raising of a weight, particularly when such weight may be made heavier in its ascent, as would be a chain with links of increasing weight.

The recoil may thus be got rid of, or by lifting the breaks no harm would arise, if it expended its force in a circular direction by the guns revolving on their common axis, but by either method the injurious strain on the vessel is got rid of, an important advantage in all ships, particularly in those constructed of iron; the third plan, which I will presently describe, brings the weight of the guns directly on the friction wheels.

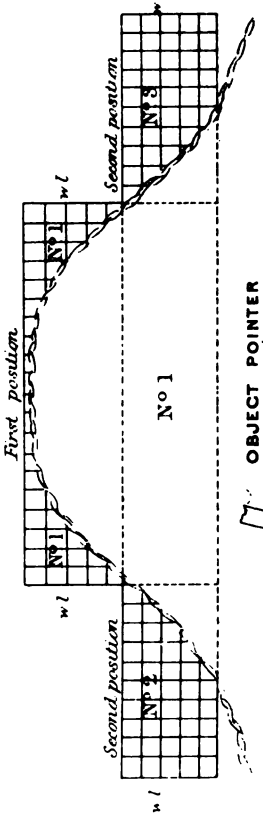
It should be observed that the rolling of the vessel cannot affect the recoil under the revolving system; the fearfully accelerated movement which this motion now adds to the recoil is, therefore, no longer to be feared, and weather guns will no longer leap in, and set at naught the puny restraints of breechings, tackles, and compressors.

The danger in heavy weather of the weather guns breaking loose from all control is so great, that, with a vessel heeling over considerably, an officer will hesitate before attempting to fire them with heavy charges, or indeed any gun directly ahead or astern (as there will, in this latter case, be considerable risk of their turning over on their sides), while a ship, for instance, is heeling over some 20°. The "Bellerophon" could not fire her guns when rolling 13°. Even on shore, without the accompanying lurch which gives such a powerful impetus to the movement, it would be a somewhat awkward experiment to fire a gun across an incline of 20°, or to allow it to recoil down it; and some of our ships indulge in heavier rolls than this.

A man-of-war should, under all circumstances of weather and position, be able to fight her guns with effect, or she becomes defenceless, and practically vacates her office.

But, under the "revolving system," whether it be to windward or to leeward, ahead or astern, in a gale or a calm, without either breechings or tackles, restrained merely by the axis on which they turn, and uninfluenced by the motion of the vessel, "revolving guns" can always be fired with perfect impunity and effect.

But to proceed with the description; there are several distinct forms in which the revolving principle can be applied, all of which permit the guns to be turned in a horizontal direction, and to be loaded and (whenever desired) to be aimed under cover, the crew being always under shelter of the plating when working the guns.


First position
Second position
Second position
No 1
No 1
No 1
No 2
No 3
w l
w l
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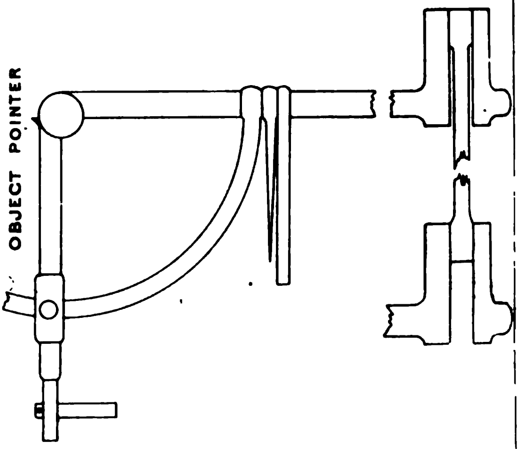
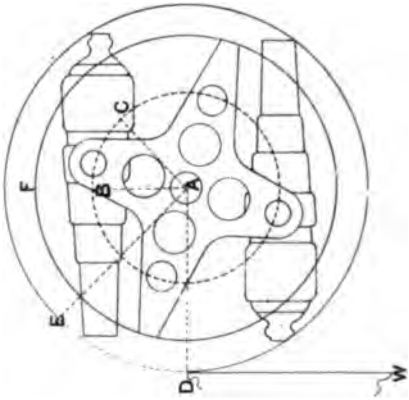
w l
w l


OBJECT POINTER

No 6


A
B
C
D
E
F
W

Under form No. 1 (Fig. 1, plate xxvii) are to be seen two side brackets with holes at the ends of their longest arms for receiving the trunnions of two guns placed opposite, parallel, and in a reverse position to each other, and equi-distant from an axis for vertical revolution, which passes through the centre of the brackets, the breech and muzzle of each gun being secured by iron fastenings to the ends of the shorter arms, which support two deck-slips, the latter having a port working on hinges under the muzzle of the gun, and when extended, the deck-slip and its port together form an exact counterpart in shape of the opening in the upper deck, through which the guns pass while revolving. When the guns are below for being loaded, they completely close the aperture, descending simultaneously with the guns rising for being fired. As the guns balance each other on the opposite sides of the brackets, so, in like manner, do the deck-slips, and thus an equilibrium is established which reduces to a minimum the labour of revolving the guns, and this labour is consequently so slight, that, with the friction-band raised, the smallest additional weight attached to any part of the deck-slips or guns, will cause that part to gravitate.

The revolving movement in the vertical plane is conducted by a purchase-wheel, turned by a crank handle; in this movement are embraced four distinct operations—the bringing the gun into action, the giving it elevation and depression, and the recoil, or running in; and no plan yet devised has combined these distinct duties in a manner so simple, and yet so perfect.

With respect to the "elevation," it is practically unlimited, the whole arc of 180° being under command; in consequence of which vertical fire, one of the most important aids in modern warfare when attacking bomb proofs and land defences, can be employed with the same ease and facility as if the firing took place in a horizontal direction.

The very limited elevation to which broadside, turret, and box-guns are confined, entirely prevents vertical fire being thought of on board vessels armed on these respective principles; and yet the necessity for avoiding torpedoes will keep our ships further from the shore, and compel them, as far as possible, to fire at higher angles of elevation.

But unlimited elevation is of great value under other circumstances, for if a vessel were stranded on the rocks, and on her beam ends, under an enemy's guns (as has happened), the guns, under the revolving system, could be fired with as much effect as if the vessel were on an even keel.

As regards "depression," it can be given to any necessary extent, either by increasing the length of the brackets, or by raising the revolving axis.

It will be observed that whenever a deck-slip occupies the aperture, the deck will present a flush appearance fore and aft.

No. 2,* in its general features, embraces the same points as No. 1, but has, in addition, a protection of iron plating attached to the guns themselves, as also two side shields of iron affixed to the rotary deck on each side of the opening through which the guns revolve, which shields, in the event of their becoming injured, can be moved outwards by screws. The protection will now be complete, without requiring an eighth of the weight a turret takes.

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* A diagram of this is not given.

No. 3 (Fig. 3, plate xxviii), although in principle the same, differs from the two last in the absence of deck-slips, and in the framework being circular, and made to fill the aperture in the deck for the exclusion of water. Two holes in the circular framework, or disc (in which the muzzles of the guns are permanently fixed) forming the only breaks in the circle, the firing can thus be continued while heavy seas are washing over the decks and guns. The disc is of variable thickness for economising the weight. The effect of this economy of weight and space, as compared with a turret, is a restoration of the guns to the vessel's broadside, where a series of revolvers, extending the length of the vessel, might be worked in any weather with perfect ease.

No. 4 (Fig. 4, plate xxix) shows another mode of applying the revolving system; in this case the connecting rods are no longer attached to the smaller arms of the brackets, but extend across from gun to gun; this allows the guns to work on their trunnions, and to move while revolving with a parallel motion, so that the upper gun can be brought more quickly under cover, in a smaller arc of revolution, by the mere insertion of a detaining bolt in the centre of one of the connecting rods: an automatic withdrawal of this bolt may afterwards take place, should a further extent of recoil be desired.

If the bolt remains undrawn, or by a self-acting contrivance be returned into its detaining position, the gun, when re-loaded, may be revolved into precisely the same position as it occupied when fired.

When the parallel motion is used, the elevation and depression have to be given by raising or lowering a movable arm, into which the detaining bolt has been inserted.

Fig. 5, plate xxix, has the same parallel motion as No. 4, but varies considerably in form, as the weight of the guns themselves is applied to the friction surfaces to check the recoil; this may also be seen in plan No. 1.

The friction wheel, *a*, with its fellow-wheel on the other side of the guns, together form a second axle, which, with the axle proper, will remain locked while the gun recoils, and thus afford an extended surface on which the two guns and their gear will press so heavily, that the friction produced will far more than suffice; the extent of this surface may be roughly estimated by the length of the upper halves of the two wheels multiplied by the breadth of the trunnions: thus, with wheels 8 feet in diameter, with friction surfaces a foot in width, there will be 24 square feet of surface, on which the whole of this weight will press equally.

To compare a 12-ton revolver with a 12-ton gun fired on shore with the same amount of recoil friction, this latter gun must have another similar gun, or an equivalent weight lashed to it, and the whole made to rest equally on 24 square feet of friction surface.

When No. 5 is applied to vessels of small tonnage and light draught, for which it is admirably adapted, instead of a second gun there might be substituted an iron box containing some of the vessel's spare gear, such as spare shackles, a length or two of chain, or any weighty and compact articles.

A point of very great advantage (not found under any other system) is the immovability of the common centre of gravity of "revolving guns;" no ill effects can, therefore, arise from the recoil of a broadside of heavy guns while the ship is heeling over.

The horizontal motion need not occupy any time in verbal description, as, owing to the weight resting principally on a central pivot and rollers, it can be accomplished with the greatest ease, particularly as there is no heavy turret of some 250 tons to be added to the weight to be moved.

There are several modes of aiming the guns, as, for instance, the captain of the gun can stand in its rear and conduct the pointing, and having the gun between the enemy he is firing at and himself, is then less exposed than he would be in a turret, where a shot entering the port might take him in the body.

In No. 2 or No. 3 plan, the man aiming would neither have his head nor his body exposed, as he would look through an aperture like a telescope in the iron disc immediately over the gun; within this aperture is the dispart, and at its inner and wider end, a tangent scale.

The back of the person aiming would certainly be exposed; this, if desired, could be obviated by a protecting band of plating extending across from one side-shield to the other.

The steadiness of aim, another point, is greatly aided by the gun recoiling under the feet of the person aiming, who no longer need spring up to prevent the gun striking him; but it is not necessary that he should even be near the gun, as the instrument I am about to describe will show.

The "object pointer" (see Plate xxx) is an instrument by means of which a person in some place of security at a distance from the gun can direct the gun with the same accuracy as if he were in the rear of it. The instrument is connected by rods with an eccentric or crank on the central pivot of the guns; the gun and the instrument will, therefore, partake of the same movement, the act of turning the guns moving the instrument in the same direction.

A person sitting behind the pointer can, through a voice-pipe, direct the guns to be trained to the right or left hand, and to be elevated or depressed, until he observes the pointer bearing on the object, when the gun will be found pointed in a similar manner; he might then pull the trigger line as if he were ringing a bell.

Except in the case of gun-boats and other small vessels, the broadside is the proper position for a vessel's guns, for which "revolving guns" are admirably adapted; and if we once get rid of the ponderous turret, however heavy the class of guns, their aggregate weight will never approach the aggregate weight of all the guns carried by a three-decked ship on her broadside; there will, consequently, be no difficulty on the score of weight.

After the safety of the water-line has been secured, every ton of weight that remains undisposed of should be turned into guns, every additional gun constituting a distinct chance of success. Much has been erroneously said of the advantage of concentrating the efforts of a broadside in a single shot, which, however plausible in theory, is untenable in practice as long as the percentage of misses so greatly outnumbers the percentage of hits; there is, indeed, no greater defect among the recent changes (for which no increase of size will compensate) than the great reduction in the number of the guns carried. The difficulties of taking a correct aim at sea appear to have been entirely overlooked.

Assuming for a moment that large guns can be handled as quickly as smaller ones, and that the crews are equal in practice, the vessel carrying a few guns must inevitably be sunk before she can make a successful hit, when engaging a vessel armed with a greater number.

Let us for instance say that five per cent. of the shots will prove successful, then the "Royal Sovereign," as a turret ship, before she could plant a single successful shot, would have to fire *four* entire broadsides; when the same vessel, if the 614 tons of turrets were got rid of, and some forty 12-ton guns substituted, would at the same rate of percentage, make a successful hit at every broadside.

With respect to the mechanical part of the question, no engineer of experience would find the smallest difficulty in revolving ordnance of 25 to 100 tons weight with the same ease and facility as Brunel revolved a paddle wheel of the "Great Eastern" of 185 tons on its semi-supported shaft.

While showing that guns of any size can be worked on the "revolving system," I would especially remark, that I do not advocate in the slightest degree the employment of those enormous mistakes, which, with wide diameters of bore, are fired with less than their saluting charges, and with a smashing, rather than penetrating power, are but carronnades on a large scale.

The difficulties which the weight of plating, entails, and which, I trust, the "revolving system" will obviate, appear to be so pressing on the authorities, that vessels with only a 4 feet 6 inches freeboard have been proposed, and are, I fear, already laid down; as such vessels, if caught in a heavy gale and sea, will, from the operation of the same causes, in all probability, meet with the same fate as the unfortunate "London," I will briefly, by means of these models, endeavour to show that a vessel's freeboard cannot, with a due regard to her safety, be reduced to the extent proposed, and that the height of the freeboard must be a variable quantity, which, within certain limits, will be found to increase with the length of the vessel, so that a short vessel of ordinary construction can enjoy a height of freeboard, which would prove fatal to a longer vessel.

All vessels, as is known, displace, without reference to their form or position in the water, a body of water of the same weight as themselves, and this invariable law causes them to float higher, or to sink deeper, according to the increase or diminution in the bulk of their hulls at the part then subjected to the passing wave, that the same displacement may at all times be maintained.

While scudding before the wind, with the seas rolling onwards at a greater velocity than the vessel, the entire length of the hull is incessantly traversed by rolling volumes of water, which, as they pass the widely differing displacements at the quarter, beam, and bow, occasion the incessant changes in the immersion and emersion of the hull, to which I have alluded; a vessel of great length relative to her beam, when on the crest of a wave at her centre, will sink into it, until she has found in its widening base the amount of displacement she has been momentarily deprived of by the exposure of her unsupported extremities, the weight of which will then press on her, as would an additional weight of cargo suddenly placed on board, and the crest of the wave, then towering above the decks, will fall, sweeping them with resistless force.

I will now describe the effect of a wave while passing the centres of a long and short vessel having the same displacements (Plate xxx).

The vessels are respectively numbered 1, 2, and 3, and are of the following dimensions:—

No.	Length.	Breadth.	Depth.	Draught.	Displacement.	Freeboard,
1	20	5	3	2	200	100
2	10	5	3	2	100	50
3	10	5	3	2	100	50
					400	

The three vessels have an aggregate displacement of 400, and whether floating separately, attached side to side, or end to end, this will continue to be their displacement.

When placed side by side they will form a vessel 20 long by 15 broad, and when end-on, one 40 long by 5 broad; we will first place them side by side, and having shown the height of the freeboard occupied by a wave at their centres, will then place them end on, and observe the result, applying the same shaped wave at the same part of their hulls.

The wave is drawn with its sides at an angle of 45°, and is marked with cubes, the same as the models, to facilitate computation with the eye, the sides then occupying the diagonals of the cubes, which will be sufficiently accurate for the present purpose.

(The side of a wave is frequently to be seen at a much higher angle.)

A vessel of two beams in length (here formed by a lateral junction of the models) is supposed to be momentarily supported on the crest of a wave at her centre, which will leave 40 cubes of the previously immersed portion of the hull exposed to view at each extremity, 80 cubes must therefore be taken from the freeboard to supply the loss, which will still leave a sufficient height of freeboard above the highest point reached by the waves, to insure the vessel's safety.

If the vessel be now divided longitudinally, and Nos. 2 and 3 be taken from the side of No. 1, the displacement and line of flotation of the latter will in no wise be altered, but if instead of attaching Nos. 2

and 3 to the sides of No. 1 (where they support themselves) we add them to the ends of No. 1, transforming all three into a vessel of eight beams in length, there will be a very altered state of circumstances, as Nos. 2 and 3 will then be entirely out of the water, and contributing nothing by their displacement to the support of their own weight, will press on No. 1 with their entire weight, forcing it down, until in the base of the wave, is met a sufficiency of water to supply the three combined vessels with the 400 tons of displacement they require.

The correctness of this may be ascertained by counting the cubes described behind the wave, the crest of which from there being no freeboard sufficiently high to restrain it, will pour over the vessel in a huge volume of water.

From this we may trace the proximate cause of the unfortunate "London's" disaster. She was of great length, with small proportionate beam, and very low in the water (without a sufficiency of freeboard in fact) and she foundered in a sea-way in which her own open boats (deeply laden) could live, and from the account of the survivors, who described the sea as falling in masses on her decks, we can have no doubt that when across the crest of the waves, as they reached her centre, she sunk so far into them that the water fell in successive seas over her imperfectly secured decks, and the same unhappy fate will attend any long low turret vessel caught scudding or athwart the waves with a heavy sea on.

If, therefore, the safety of the vessel and her crew are to be at all regarded, there must be no diminution, but a large increase of the freeboard in the long low vessel; turret and box vessels, equally with broadside, are under precisely the same conditions as regards the height of their freeboards, and we cannot recognize the claims of their advocates for a special exemption from the general law.

I will now briefly enumerate some of the principal advantages which the "revolving system" offers.

1. It requires no armour-plating for its special protection, and enables all that is now placed on the top sides and turrets to be employed in the more important office of protecting the "wind and water" part of the vessel.

2. Or in the event of not being required for such a purpose, it relieves so much dead weight, which can be devoted either to a large increase of the armament, or to a considerable decrease in the size of the vessel.

3. From its lightness and compactness, it is adapted both for a ship's broadside, and for the smallest gun-boat.

4. It affords complete protection both to the guns and their crews.

5. It requires neither breechings or tackles in the heaviest weather, and the guns, although movable, are yet always permanently attached to the vessel by the axis on which they revolve, which latter only turns in a horizontal direction.

6. The centre of gravity of the guns, whether they are being fired, or otherwise moving, is always immovably fixed.

7. The guns can be elevated through the entire arc of 180°, and con-

sequently vertical fire, which has hitherto been confined to mortars, can be commanded in all vessels.

8. A greater degree of depression than has hitherto been attempted can be given without the present serious increase of weight required in turrets.

9. There being no heavy turrets to move, nor guns to transport (as in box vessels), the horizontal training can be performed with greater rapidity and ease than under any other system.

10. The "elevation," "depression," "running out," and "running in," are all comprised in the one vertical movement, and require neither steam power nor the employment of any greater number of men than are necessary for spongeing and loading.

11. The guns are loaded entirely under cover of the freeboard-plating, and from the inclined and convenient position of the gun, with greater rapidity than under any existing system.

12. While one gun is being aimed the other can be loaded.

13. Although unnecessary (from the labour being so light) the recoil of one gun can be made to bring up the other ready for action.

14. The guns being entirely independent of the motion and inclination of the ship, can be fired in all weathers, and in any position, which no other gun yet invented is capable of.

15. "Revolving guns" require no greater security in a gale than in a calm, and can always be kept in a state ready for action.

16. Owing to the guns (or to one gun and its equivalent weight) balancing each other, a gun can be brought into action, or withdrawn from action, without having been discharged, by the mere turning of a winch-handle.

17. The injurious vibration caused by the explosion of heavy charges becomes neutralized by the recoil taking place in a circular direction.

18. The steadiness of aim is greatly increased, as the person aiming has not to spring up to avoid the recoil.

19. The guns can be fired with the sea washing over them, without the water getting below.

20. If, for any purpose, a turret be desired, its iron plating, greatly reduced in height, diameter, and weight, and without a port, may become a fixture, by revolving guns passing through its roof.

I wish, before concluding, to make a short allusion to Captain Moncrieff's gun, which, although widely dissimilar in form, to a certain extent seeks the attainment of the same object for the land service. Having never seen the gun, I can only quote from the copy of the patent, and from the description given by the public papers.

It appears that a gun is attached to the outer part of a wheel, which moves to the rear when the gun is fired, causing the latter to descend under cover, in a cycloidal curve, the force of the recoil at the same time raising a weight attached to the wheel, which afterwards, by gravitation, on the release of a bolt, restores the gun to the position it occupied when fired.

The governing principle seems to be the "storing up" (the words used) of the force of the recoil for bringing the gun into action, but when the gun misses fire, or is fired with a reduced charge, and has to be brought under cover, the application of considerable additional power, more than equal to the force of the recoil, appears to be necessary.

A very essential difference between the two systems is at once apparent, the "revolving guns" being always equally poised, work on a securely fixed axis in a circle (instead of a detached one on a cycloid), are independent of the recoil, and can be brought in and out of action with very trifling labour, a seven-ton revolver only requiring seven tons, or even less, and which may be a spare gun, instead of 14½ tons of elevator and ballast for the movement.

With revolvers, vertical fire can be given, and these guns can be elevated and depressed to any extent by the same movement which brings them into action.

With Captain Moncrieff's guns the first appears to be impossible in any shape, while the latter is very limited and requires a screw and a distinct operation; it does not appear that this system is capable of affording the thorough protection which is to be found under the No. 3 mode of applying "revolvers;" but I will not pursue the comparison.

Enough has probably now been shown to prove that the "revolving system" possesses no common advantages, and that it is capable of a wide development; the limited time at my disposal forbids my describing the advantages it possesses for the land service.

In referring to other systems, I have endeavoured, and I trust successfully, to avoid giving offence to those interested in them.

I have shown that our supposed impenetrable fleet of iron-clads are in no safer position than wooden vessels, and that a remedy lies at our doors, and I would ask whether it be wise to neglect for a day the great interests now at stake.

Let us remember that foreign powers are quite aware of the weak points of our position, and that so long as that position is assailable we invite attack; that all our gun-boats are below the mark, and will be swept away, and that the weak plating of our iron-clads will be easily penetrated by comparatively small guns, are not my remarks, but the remarks of those whose experience and opinions cannot be lightly disregarded at a time, when that cloud in the far west may rapidly increase and cover our waters and destroy our commerce, with fleets of hostile gun-boats, quickly extemporized, with which our present iron-clads will find it difficult, if not impossible, to cope successfully.

The CHAIRMAN: There are one or two points which I should like to have elucidated. The first is, what is the depth of hold required, and what would be the draught of water in a gun-boat to carry two of those guns? Next, I do not make out in what position of the gun the loading takes place? Again, in the case of any accident happening to the lower gun, such as its bursting, it seems to me that it would be fatal to the whole apparatus. Then, I think you mentioned that one gun might be loaded whilst the other was being pointed. If the two guns are attached in that way, I cannot conceive how the captain of the upper gun can point accurately to half a degree without being disturbed by the ramming home of the charge of the lower gun.

Captain SHARPE: I may say that the question of loading the two guns, the lower one being loaded when the upper one is being fired, is quite a secondary object, and is only intended for rapid firing at close quarters.

The CHAIRMAN: Then the second might do as a spare gun.

Captain SHARPE: Yes. I attach no great importance to the lower gun, except as a spare gun, or for rapid firing, and for alternating with the upper gun (to avoid heating). The upper gun, as you see, can, in every case, be loaded under cover. In some cases, I have applied a weight below instead of another gun.

Mr. MICHAEL SCOTT, C.E.: I should like to ask in what kind of vessel you propose to employ these guns? I understand that you object to the turret system. I believe that you desire to have a high free-board, and that your guns would be carried on the broadside exclusively. My inquiry is more with reference to the relative weight of metal required for the turret and the broadside.

Captain SHARPE: The first question was, does the vessel for this gun require any great draught of water? No, it does not; and provided you adopt this form (showing) you may have the gun of any size you like. You can judge of the draught by the length of the gun. A very shallow draught will do. That is what Mr. Watts appeared so struck with. The smallest vessel would admit the gun. You can judge the depth required by taking the length of the gun as a guide. The next question was, how does the loading take place? When you are firing in this way (showing), you will, of course, load with the gun horizontal, under cover. But if you revolve the guns, you would load at an angle of about 45° (Fig. 1); the shot and the charge would almost roll in.

The CHAIRMAN: I am afraid they would roll out again on the gun going round.

Captain SHARPE: The gun revolves, so that the shot rests on the bottom of the gun. If the order were given for 10° of elevation, the elevation could be given thus. You see by this model that this gun can be loaded while the other is being pointed; but, as a practical man, I do not attach any importance to that, except when you are alongside an enemy, and wish to rattle in your shot as fast as you can. I do not care much about *using* the lower gun, except as I have stated, but I do care about having a *second* gun, because if the upper gun gets damaged, there is another gun to revolve immediately into its place, with the same gear and the same facilities for firing.

Captain BURGESS: Would you not have to attach a weight in its place if the upper gun were to get injured, and you have to unship it?

Captain SHARPE: We should not unship it, we should keep it, although injured, as a counterpoise. The question was asked what kind of ship would carry these guns? Any kind of ship you might apply them to (as I mentioned in my paper), even to the turret. You might cut the turret down one-half, and let the gun pass through the top. Still, I think it is a gunnery mistake to have a central gun. Here is a section of the "Warrior" (showing diagram), with two 12-ton revolving guns on the same scale, mounted on the broadside. Taking the upper plating off, and adding it to the sides below, several such revolving guns can be used, and also be protected, and the "Warrior" turned into a more valuable frigate, with much thicker plating on her sides.

The CHAIRMAN: Would you not, as a general rule, carry heavier guns on the mid-ship section, not only as to the disposition of weights, but a larger gun requires a larger revolving apparatus? Would it not be better to carry that larger apparatus on the midship section, with depth of hold in the centre compartment, than on the sides?

Captain SHARPE: Undoubtedly, if you have the apparatus on a very large scale. But in this section of the "Warrior" you see the apparatus for two 12-ton guns scarcely extends beyond the decks.

Mr. MICHAEL SCOTT: I am very much pleased with your double axle.

Captain SHARPE: Yes, the moment it occurred to me, I felt not a doubt of its value.

Mr. MICHAEL SCOTT: You are in favour of a high free-board?

Captain SHARPE: Yes, but with a low protection only.

Mr. MICHAEL SCOTT: Would you carry that protection below the water-line?

Captain SHARPE: Undoubtedly.

The CHAIRMAN: If no other gentleman wishes to make remarks, it is my pleasing duty to ask the meeting to join me in thanking you, Captain Sharpe, for your very good and entertaining lecture. The subject is quite new to me. Having heard your explanation, I really cannot see any of those difficulties which I must say I anticipated, when I first came into the room. Your plan seems to me much more feasible now, though there are some of the details in which practice might show modifications to be necessary.

Evening Meeting.

Monday, May 17th, 1869.

WILLIAM STIRLING LACON, Esq., in the Chair.

NAMES of MEMBERS who joined the Institution between the 3rd and 17th May, 1869.

ANNUAL.

Bannister, C. W., Major late 2nd Bombay Cavalry. 1*l.*
Haye, J. B., Lieut., R.N. 1*l.*
Whiteside, F. J. S., Capt. 11th Regt. 1*l.*

THE CONSTITUTION OF OUR MILITARY FORCES, AND THE CONDITIONS OF MILITARY SERVICE.

By Colonel A. Cunningham Robertson, Commanding 2nd Batt., the 8th or King's Regt.

Mr. President and Gentlemen—You are aware that when the Council accepted my offer to say a few words by way of introducing this subject for discussion, they knew that I had no intention to submit for the consideration of the members of the Institution, any complete plan of my own. What I proposed to do was, to endeavour to classify and analyze what had been written and spoken on the subject of the reorganization of the Army, with the view of giving an opportunity for the discussion of those points regarding which a difference of opinion exists. At the time I offered to undertake this task, it did not appear very formidable; but since then there has been so much written and so much spoken on this subject, that I have found it rather difficult to make myself familiar with all the opinions and suggestions which I had to examine. I have, however, worked diligently in order to accomplish what I promised. I have made notes from all the pamphlets which have been written on the subject, and from the newspaper reports of all the speeches that have been made in Parliament. The result is this bulky roll of MS. which I hold in my hand. I shall not attempt to read these notes to you in their present shape, as I am sure that they would be neither interesting nor easily understood. I hope, however, to be able to submit them to the Council in a more compressed form, and should they think fit to publish them, they will, I think, be found to embody a tolerably complete abstract of the actually existing state of opinion at this most interesting epoch in the history of our Military Institutions when, under the auspices of His Royal Highness the Duke of Cambridge, it seems likely that even greater changes will be made, and even greater improvements effected in the organization of the Army, than those changes and improvements which have rendered memorable the period during which his illustrious predecessor, the Duke of York, commanded the Army.*

The declaration of the policy of the Government made by Lord Northbrook leads me to hope that the Ministerial programme will, if adopted by Parliament, give practical effect to most of the suggestions made by Sir Charles Trevelyan. Many of these suggestions, which thirty years ago would have been irreconcilably at variance with the feelings and convictions of the Officers of the Army, are now in perfect accordance with the opinions and sympathies of most Officers who have studied the subject. Of course, however, those who undertake to introduce changes in existing institutions must always be prepared to contend with difficulties and to overcome opposition. There is always a certain inevitable amount of opposition to be encountered, which proceeds from the united forces of ignorance, of prejudice, and of adverse personal interests. To attempt to overcome opposition of that kind by reason or argument would be futile. The only practical manner of dealing with it is, to estimate its amount, and to consider whether it is most prudent to disregard it or to repress and control it by the direct intervention of authority. But there is another kind of opposition which arises, not from passion or prejudice, but from the difficulty of appreciating correctly the various conditions and circumstances which must be taken into account in estimating the effect likely to be produced by any proposed measure. A comparison of the different estimates formed by different individuals of the effects likely to be produced by the same measure; and a discussion of the grounds on which these estimates rest, must, I think, tend to modify and diminish differences of opinion. If a measure be really good and expedient, the more fully and the more frequently it is discussed, the smaller will become the minority of those who oppose it, the greater the majority of those who approve of it.

In going over the very numerous and highly important topics included in the subject of this evening's discussion, I shall therefore either altogether omit or else touch very slightly on those points concerning which all, or nearly all, who have written or spoken on the subject seem to be agreed; and shall devote the short time at my disposal to making a few observations on those points respecting which there still exists a considerable difference of opinion.

What we want to do, stated in general terms, is this—We want so to organize our national forces and resources as to render them available for the purposes both of offensive and defensive warfare, and to provide for every requisite service being performed in the most economical manner, consistent with perfect efficiency. But although military efficiency is the chief and primary object to be kept in view in organizing our Military Institutions, Sir Charles Trevelyan has pointed out that a statesman who deals with this question ought to bear in mind that these institutions exercise a permanent and constant influence over the national character, extending over periods of peace as well as over periods of war, and that the duration of periods of peace always greatly exceeds the duration of periods of war. Hence, therefore, although subsidiary and subordinate to the paramount requirements of military efficiency necessary to secure success in war, it is nevertheless an object of the greatest national interest to impress such a character on our Military Institutions as to make their operation during time of peace beneficial to the population, and to make the influence they exert, favourable to the development of the moral and intellectual, as well as to the physical energies of the labouring classes. In one of the most interesting passages of that most instructive little work which has become the text-book of all who wish to attain an accurate knowledge of what the British Army actually is, and also a distinct idea of what it ought to be and might be, and it is to be hoped will soon become, Sir Charles Trevelyan points out those particular arrangements by which the special processes of military training might be made subservient to a general scheme of popular education, so that a year's military duty might, in the education of young men of the labouring classes, produce beneficial effects analogous in kind to those which are produced by university training in the education of young men belonging to the upper classes of the community.

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* Vide Appendix.

Sir Charles Trevelyan's views respecting this subsidiary function of Military Institutions are confirmed by the authority of General Trochu. As regards this matter, the views of the distinguished French soldier and of the distinguished English civilian are identical. On a point of that kind a complete coincidence of opinion between two such eminent, and at the same time such completely independent authorities, is conclusive; and in any future attempt to frame a scheme of national military organization, the necessity of rendering military training a means of promoting success in civil occupations will, no doubt be recognized as an essential condition of the problem.

What we mean, then, by an efficient Military Organization of our national forces is, not merely an organization which shall produce an Army thoroughly trained in military exercises, and perfectly adapted for all the purposes of war, but, further, an organization which shall render military training a powerful instrument of popular education, so that the same process which renders a young man an efficient soldier shall also improve his character, and develope his bodily and mental capacities, rendering him in every respect a more perfect man and a better citizen. I think we are all agreed that this is what we want to do, that this is the kind of organization we want to attain. I think, also, that it is very generally believed that those things which we want to do, the Prussians have actually done; and that such an Army as we want, they have got. Does it therefore follow, that to obtain the same results the best thing we can do is to make use of the same means? Many people think so. They say no country in the world has a more efficient Army than Prussia. No country is better prepared for war. Therefore, say they, let us imitate Prussia; let us adopt Prussian institutions. It has, however, been very forcibly pointed out that in many most essential respects the circumstances of England are very different from those of Prussia, and that the conditions of security being different, that kind of organization, and those methods of defence, which are indispensable for Prussia, are by no means necessary for England, nor in any respect so suitable as are other organizations and methods. The security of Prussia altogether depends on the efficiency of its Army; but the Army is not the sole nor even the chief defence of England. We are protected by the ocean, by the floating bulwarks of our magnificent Navy, by the formidable fortifications which cover our chief arsenals and harbours. The Channel, to use the words of Lord Northbrook, is "our natural ally;" and if this is forgotten in considering how to organize our military forces, we omit from the problem the most important of the conditions which determine the method of its solution. Prussia cannot be effectively defended unless its armies are able to leave their own territories, and to assail their enemies on a foreign soil, and on battle-fields far distant from their own frontiers. For England, on the contrary, the best method of defence will generally be to await attack. By adhering to this policy, we shall be able to make our preparations for resistance under much more favourable conditions than the Prussians. We shall be able to obtain an equal, or, rather, a much greater degree of national security by means of an organization much narrower in its objects, and much less stringent in its provisions.

As regards the particular measures most suitable for the defence of England, a great variety of suggestions have been made, and some of these differ very considerably from others: but after reading a large mass of pamphlet literature, reports of parliamentary debates, and newspaper articles, what struck me most, and what I think will strike any one else who goes through the same course of reading, is, not the diversity, but the great similarity of these suggestions. As regards general principles, there is a very striking concord of opinion. As regards matters of detail, though there is considerable diversity, yet methods which differ are not always contradictory. Some suggestions which differ, are really supplementary to one another; both are capable of being usefully combined in the same scheme, *e.g.*, Colonel Baker has suggested a mode of recruiting the Militia by ballot, not as a substitute, but as a supplement to the mode of recruiting by voluntary enlistment.

The mode of enlistment is the essential point which determines the character of the military institutions of a state, and is one of those points on which diversity of opinion exists. Every one is agreed that in time of peace, to make military service compulsory would, in this country, be practically impossible. Conscription in England is certainly impossible; but is it equally certain that, if possible, it would be inexpedient? that if a statesman had it in his power to choose whether the national forces should be raised by voluntary enlistment or by conscription, the highest interests of the nation, namely, those which affect the morality of the people, demand that he should decide for voluntary enlistment? This is what Lieut.-Colonel Bannatyne thinks. In his very able pamphlet, published in 1867, called "Our Military Forces and Reserves," after describing the Prussian system of conscription, he says:—"Every adult, able-bodied male in this population is thus made a soldier. Such a system cannot but demoralize the whole population, and unfit them for the occupations of civil life."

I wish to lay emphasis on the word "demoralize," and to contrast this opinion as to the moral effects of conscription with that of Sir John Burgoyne. Like everybody else, Sir John admits that it may be good economy to pay a large sum out of the Treasury, and to spare the industry of the nation. "Man for man," he says, "a soldier in the "British Army costs much more than a soldier in the French or Prussian Army." Nevertheless, speaking economically, we may be gainers, and wise in our generation; "but," he goes on to say, "do not let us "think that by paying money rather than the tribute of blood we are "doing anything praiseworthy. Productive industry is not the sole "source of the prosperity of a country; there are moral qualities de-"veloped in the training of a recruit which springing, as it were, from "the Army as a source, permeate through the lower strata of society, "and add largely to those qualities which make up the greatness of a "nation." In this pregnant sentence, the noble veteran clearly indicates the real character of the motives and influences which make us prefer voluntary to compulsory military service, and which are so powerful as to render conscription in any form practically impossible in England. Why should economical considerations be considered paramount? Is it good for a nation that these interests should always prevail? Are not the interests of industry selfish interests? The private individual interests of the manufacturer, of the merchant, of the shopkeeper, always distinct from the interest of the State, sometimes contrary to them. These men shrink from the idea of being personally liable to military service; they shrink from any sacrifice of private interest to public duty. Their object is so to shape the policy of the State as to make it subservient to their own private interests. They repudiate or evade the obligation of sacrificing these interests for any object in which they have no immediate concern, however essential that object may be to the welfare of the nation and to the preservation of the virtues of the people. But was it acquiescence in such demands that made Greece great, or Rome great, or Prussia great, that, in the recent great American contest, gave victory to the North and glory to the South?

It may not be necessary, and if not necessary, it may not be politic to exact from Englishmen that tribute of compulsory military service which Prussians and Frenchmen are obliged to render; but it is certainly not merely politic, it is infinitely important, so to frame our institutions and so to conduct the government of the country, that every man among us may feel the obligation to sacrifice his own individual interests for those of the State.

Freedom from conscription is an advantage dearly purchased, if it cause the spirit of patriotism to decay, if it tend to strengthen the power of selfish motives, or to weaken the influence of the obligations of duty, if this immunity exists, because our statesmen believe that material prosperity should be the chief object of the exertions of individuals, and of the policy of the nation.

These are the considerations which in my opinion render a suggestion of Colonel Baker's well worthy of the attention of statesmen. He proposes to draw by lot from the population, 500,000 men, to be inscribed in a list, from which at any time when required, men might be drafted by a second ballot, to fill up vacancies in the ranks of the Militia. Under such a system, in the present state of our foreign relations, the liability of any individual to render compulsory service would, if calculated by an actuary, be found to be merely nominal. Without therefore inflicting any appreciable injury on individual interests, it would be possible, by adopting this scheme, practically to apply the principle of conscription to the constitution of our military forces. Lord Elcho, although he has not, so far as I am aware, pronounced any opinion concerning Colonel Baker's suggestion, has spoken very decidedly and forcibly in favour of its principle. He wishes that something more should be done than merely to retain in the statute-book the power to ballot. He thinks this power should be actually exercised, and that every year a certain number of men should be selected for the militia by ballot, just to keep the people in mind that military service is one of the obligations of every citizen.

God forbid that a great national disaster, or even that any formidable national danger should ever force us to adopt conscription as a necessity. Nevertheless, of two evils, it is better that a nation should occasionally suffer the calamities of war than that, during a long period of peace and prosperity, the spirit of selfishness should gain strength, and the spirit of self-sacrifice and obedience to the obligations of duty should decay.

While, therefore, I admit that, on the grounds of expediency, we must accept the principle of voluntary enlistment as the basis of the constitution of our military forces, I think that any statesman who undertakes to re-model our military institutions, should attentively consider the moral and political advantages to be derived from adopting some such suggestion as that of Colonel Baker, for recognising and giving practical effect to the principle of compulsory service.

The next point to be discussed, is "the duration of the military engagement." The weight both of argument and of authority is clearly in favour of a short term of service. Sir Charles Trevelyan's numerous admirable writings clearly demonstrate the moral advantages of a short term of enlistment, and the most able and interesting paper lately read in this Institution by Lieutenant-Colonel Leahy, demonstrates with equal, or rather let me say (since his conclusions are supported by irrefragable arithmetical calculations) with still greater cogency, its economical advantages. It is true that Lieut.-Colonel Bannatyne, who has discussed this question with his usual ability, is in favour of a long term of service. He feels strongly as a practical soldier, the difficulty of adapting the arrangements necessary for filling vacancies in the ranks of our great Indian Army, to a short period of enlistment. But Colonel Bannatyne's pamphlet is dated 1867. At that time Colonel Leahy's paper had not been read, and Sir Charles Trevelyan's criticisms and suggestions had not been published. I shall therefore pass over the objections to short terms of service, which have been very ably stated by Colonel Bannatyne. I do so, not because I consider them unfounded, or even unimportant: I admit both their reality and their importance; but the advantages of short terms, as stated by Sir Charles Trevelyan and Lieutenant-Colonel Leahy, appear to me very much to exceed the disadvantages, as stated by Lieutenant-Colonel Bannatyne; and this seems a sufficient reason for declining to discuss an opinion formed before Colonel Leahy had spoken, or Sir C. Trevelyan had written. But there is another Officer who, although it is to be presumed that he is cognisant of all that has been said on the subject by Sir Charles Trevelyan and Lieutenant-Colonel Leahy, still maintains the same opinion as Lieutenant-Colonel Bannatyne. Sir Archibald Alison is now publishing in a separate form, two articles on "Military Organization," originally contributed by him to *Blackwood's Magazine*. The work is still in the press, but I have been favoured with a copy of the proofs, and I presume many gentlemen here present are familiar with Sir Archibald's views, as stated in the pages of *Blackwood*. I should think many of those I am addressing must, like myself, have felt astonished when they found so able and well informed an Officer arguing in favour of the expediency of long enlistments. I have a great respect for his opinion, and have read his statements and arguments very carefully. He quotes the great names of Napoleon and Wellington as conclusive authorities concerning the value of old soldiers. But if Sir Archibald will read carefully what General Trochu says about *le jeune* and *le vieux soldat*, he will learn to avoid the fallacy of confounding an old soldier and an old man. He will learn to avoid deceiving himself and his readers by quoting words spoken of young men in time of war, who had served two or three campaigns, as if they proved the expediency of binding men to serve in time of peace for 20 years in the ranks.

Both the weight of authority and the force of argument are so unequivocally in favour of short enlistments that, although Lord Northbrook did not speak very decidedly on the subject, it seems extremely probable that the thing will be tried.

The Duke of Cambridge suggests a safe mode of doing this. He says (what I think even the most sanguine promoters of the new system must feel to be true), "It is impossible for any one to "feel sure if a short term of service will take with the country, if, "under our voluntary system, it will prove sufficiently popular to secure "as many recruits as are wanted; therefore, (says His Royal Highness), "let the two systems be tried concurrently; let recruits have the option "of enlisting either for a long or short period, as suits them best."

We have a corps of Guards about 6,000 strong. These troops not being liable to take their tour of foreign service, might be enlisted for a short term without inconvenience. The only thing to be considered would be, what is the most advantageous arrangement for the performance of home duties. Suppose that the total engagement was for seven years, and that the conditions of service during this period were so arranged that each recruit enlisted should pass one year at a depôt, two in the ranks, and four in the reserve. Under this arrangement one-third of the force, or 2,000 men, would annually pass into the reserve, and at the end of seven years we should have 2,000 at the depôt, 4,000 in the ranks, and 8,000 in the reserve, being a total of 2,000 recruits and 12,000 trained soldiers.

As regards the interests of the State, the advantages of a short military engagement are numerous and indisputable. But as regards the interests of the recruit, I do not agree with Sir Charles Trevelyan in thinking that the effect of reducing the duration of the engagement would be to render the service more attractive. As the Army is at present constituted, one of the chief inducements which attracts recruits, is the certainty of a life-long occupation and of a provision for old age. Colonel Leahy has pointed out that the statistics of re-engagements clearly establish the fact, that the motive that induces the great majority of recruits to enlist, is the desire to obtain permanent employment; and although it is true that there are at all times in the ranks of the Army a great many soldiers who are discontented with the service, and who desire to leave it, yet this does not by any means prove, that at the time of their enlistment even these men would have considered it an advantage, if the conditions of their engagement had been such, that military service, instead of being a permanent employment, had been merely a temporary occupation for a specific term of years. It, however, deserves to be noted, that the adoption of a system restricting the period of military service to a short term of years does not by any means prevent the desire of obtaining permanent employment continuing to operate as a motive of enlistment. Under such a system, of course all non-commissioned Officers, and probably also a certain proportion of picked privates, would be permitted to re-engage. Although, therefore, only a small number of those who enlisted would actually obtain the advantage of a second engagement, yet the hope of obtaining it would be common to all, and I think it quite possible that this hope might, in many individual instances, practically have almost as powerful an influence in inducing a recruit to enlist, as the certainty of obtaining a permanent life-long occupation conferred by the present conditions of enlistment.

If, however, an advantage which was formerly offered to all who applied for it and secured by contract, be made contingent on good conduct, and if it can only be obtained by one out of many competitors, it is evident that the value of that advantage measured, not by its effect on individual minds, but by its effect on the general labour-market, must be diminished; and if the same number of labourers are required we must offer some equivalent to make up for this diminution of value. Since then the effect of a change of system which will convert military service from a permanent employment into a temporary occupation, must necessarily be to render it less attractive, and since also the number of recruits required, increases in the same proportion as the term of service is shortened, it will evidently be impossible to keep our military establishment complete, unless some advantage is offered to soldiers which is at least equivalent to the difference in value between an offer of permanent and an offer of temporary employment.

Sir Charles Trevelyan's proposal to make military service a condition of obtaining civil employment would, if adopted, no doubt give Government a very extensive command of the labour-market, and prove a most effective means of obtaining recruits. His proposal merely refers to the lower branches of the civil service, but, both on the ground of abstract principle and of practical expediency, I think that military service of some kind should be exacted from those who seek the higher, as well as from those who seek the subordinate appointments. The treasury clerk might be selected from young gentlemen who have held commissions in a Militia regiment, or served in a Volunteer corps. Policemen and letter-carriers from soldiers who have served in regiments of the line.

To establish a connection of this kind between the military and civil services would be a benefit to both. The effect on the military service would be to attract recruits and to act as an incentive to good conduct, on the civil service to diminish the evils which spring from the abuse of patronage. I do not, however, feel at all sure that such a measure as that proposed by Sir Charles Trevelyan would of itself be sufficient to attract a supply of recruits adequate to the increased demand that would be caused by shortening the term of service. I think it would very probably be also found necessary, as suggested by Lord Elcho, to offer to soldiers, for three or four years after their discharge from the Line and transfer to the Reserve, a reduced rate of pay, say sixpence or fourpence per diem.

The next question to be discussed is that of "organization." In this respect our military institutions are singularly defective. It is admitted that we have no organization beyond that of the regiment; there is no unity of command, no machinery for the exercise of an efficient supervision and control. The Militia, the Volunteers, and the Line are each independent of the other, and quite destitute of any systematic arrangements for ensuring their combined action. The remedy for this state of things is completely in the power of the Government.

In devising a scheme of enlistment, Her Majesty's Ministers cannot calculate with certainty on the effect of the measures they adopt. They know that such and such measures will be advantageous to the State, but they cannot tell how they will affect the private interests of individuals, and unless these private interests are in accord with the public interests, recruits will not accept the terms they offer, and their measures will fail. But as soon as the men are enlisted, the manner in which they are organized is a matter which a Minister can deal with as he pleases.

Lord Northbrook has informed us that the Government have resolved to deal with this question, and that measures will be adopted for ensuring unity of command, effective control, and combined action of all our military forces.*

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II. That the command of regiments of Militia should be conferred—
- *a.* On Colonels placed on full pay at the expiration of a term of five years in command of a regiment of the line.
- *b.* On any field Officer of the line desirous of being placed on half-pay, conditionally on his undertaking to perform this duty.

III. That no Officer should be allowed to hold the appointment of Adjutant of a regiment of Militia, or of a Volunteer corps, for a longer period than three, or at the most five years.

IV. That Officers should be selected for these appointments from unmarried Captains of regiments of the Line, a preference being given to those who had formerly been Adjutants.

V. That during peace, the appointment of subalterns to regiments of Militia be discontinued, and during the annual training, their duties be performed by subalterns detached from regiments of the line.

The 1st of these suggestions has been already made by Sir A. Alison, and also, I think, by Lieut.-Colonel Leahy.

Lieut.-Colonel LEAHY: I said the Colonel on the Staff should be made a higher rank than it is at present.

Colonel ROBERTSON: To prove the utility of the suggestion, I submit the following reasons:—In time of peace, the principal and most useful function of an Army is to serve as a school of instruction. As soon, therefore, as an Officer has commanded a regiment for a sufficient time to obtain a thorough practical knowledge of the duties of this important office, it is desirable that he should be removed, so as to afford the same opportunities for perfecting the regimental training of another Officer. The object of our arrangements should be, in a given term of years to train as great a number of Commanding Officers as is consistent with the efficient training of each individual Officer included n that number. Of course this suggestion is only applicable to a period of peace. In time of war, the interests of the public require that the duration of the tenure of the command of a regiment should be regulated by the capacity of performing efficiently the duties of a Commanding Officer. The longer a good Officer holds his appointment, the better for the public; but in time of peace, precisely the reverse of this is the case. The better the Officer, the shorter should be his term of command. As soon as he has thoroughly learned his work he should be removed, to give an opportunity for training the next in succession.

An OFFICER: What about his money?

Colonel ROBERTSON: Of course he must have compensation. I have thought about the best manner of giving it, but I cannot go into this question at present. It is a matter of detail. I have, however, stated in my 2nd suggestion how I think Colonels should be employed during the interval between their completion of the prescribed term of Regimental command, and their promotion to a vacancy on a fixed establishment of Major-Generals. I think it will be admitted that during this interval no more suitable employment could be found for a Colonel than the command of a Militia regiment, and it is also obvious, that for Militia regiments, no more efficient Commanding Officers could be found than Colonels thoroughly trained to their work by at least five years' experience in a regiment of the line.

Taken by itself, my first suggestion might be represented as equivalent to a proposal to cut short the career of an Officer and to deprive the State of his services at the very moment when his training had been completed, and when his value as an accomplished public servant had reached its maximum. But taken in connection with the second suggestion, my proposal really is to increase the supply of thoroughly trained Commanding Officers, and to assign to every Officer so trained, a duty which, without such training, cannot be efficiently performed.

The utility of my 3rd and 4th suggestions, is so obvious that they scarcely require any comment. By making Militia and Volunteer Adjutancies, Staff appointments, and restricting their tenure to a short term of years, we should effectually suppress the scandalous traffic in these appointments, which the imposition of a stringent declaration has utterly failed to check. This measure would also put an end to the flagrant abuse of allowing these important appointments to be held by men of advanced age, who take little interest in their work, and are not capable of performing their duties properly. I met at Aldershot last year a Militia Adjutant, under whom, more than twenty years before, I had served as a subaltern. He was then a very able Officer, and is so still, but what interest could he feel in the performance of subordinate duties when brought into contact with Officers formerly junior to him, now in command of Regiments and Brigades?

I look upon a young and zealous adjutant as no less essential to the sound constitution of a Militia regiment than an experienced and thoroughly efficient Commanding Officer. If an appointment be sought as a means of procuring experience and distinction, and as a stepping-stone to further advancement, its duties will be performed in a very different manner than if it be sought, I will not say as a sinecure, but as an eligible retirement, for which past merits will be accepted as a valid claim, and no promise of future exertions required.

I come now to my 5th suggestion. Under the existing system it is obvious that we cannot get subalterns for Militia regiments. Moreover, if we could get them, until sufficiently instructed to take command of a company, subalterns would be of no use. This amount of instruction could not be given them during a few weeks of training. Subalterns in a Militia regiment would, therefore, add nothing to its efficiency; they would be like apprentices bound to a master, without a shop, without tools, without any apparatus for affording them the practice necessary to acquire skill in his craft. Under the present system of short annual training, the only practicable means of obtaining the assistance of properly instructed subalterns, of subalterns who have finished their apprenticeship, and are sufficiently instructed to be employed as journeymen, is *to borrow them from the line.* One effective Officer per company is perfectly sufficient for training purposes, so that only three or four subalterns per battalion would be required in order to provide for occasional absence and casualties among the Captains. The duty would probably prove more interesting to the subalterns employed, than the ordinary routine of regimental work, and if zealously performed, would certainly be very instructive to them.

In a leading article of the *Times* of 1st May it is said that if 140,000 thoroughly good soldiers could be put in the field at a week's notice, no Army competent to face them would be likely to reach these shores. Those who believe that to be true, must, I think, accept the inference drawn by the *Times*, that if every regiment of Militia could be so constituted and trained as to render it as effective as a battalion of the line, the first and most immediate problem of Army reform would be solved. The writer in the *Times* admits that, to establish a Militia 140,000 strong, as well officered, as well equipped, as well trained, and as well organized as soldiers of the regular Army, would be no easy matter; but I agree with him in thinking that if the Government and the nation were convinced that this was the first result to be secured, its accomplishment would not be far off. The first and most important step towards the accomplishment of such a result would undoubtedly be to secure for each Militia regiment a thoroughly efficient corps of Officers, and this, I venture to think, would be effectually and easily done by the adoption of my suggestions.

There is an opinion of Sir Charles Trevelyan's, respecting which I am anxious to offer a few observations. Sir Charles thinks that you cannot expect to get any good service out of an Officer unless he is well paid, and that gratuitous service is generally bad service. Sir Charles has not stated what grounds he has for holding this opinion, which seems neither consistent with actual experience nor with a correct appreciation of the power of pecuniary motives, as compared with the power of other motives to exertion. In all recent wars, among those Officers who have most distinguished themselves for their intelligence, their gallantry, and their zealous devotion to their duties, there has always been a fair proportion of Officers possessing sufficient means to render them independent of their pay, and who have invested in the purchase of promotion, sums so large that the interest of the money invested, would have been equivalent to the pay of the promotion purchased. It is, therefore, no exaggeration to say, that in the Guards and Cavalry there are many Officers who serve for nothing. Has it ever been found that Cavalry Officers and Officers of the Guards are inferior in courage, in intelligence, in zeal, to Officers of Infantry regiments? Does not Sir Charles believe, that no work is really first-rate unless the workman feels a pleasure in it, and is more influenced by the ambition of excellence than by the desire of profit. Why then should he think that Officers cannot be depended on to do their duty properly unless they are highly paid?

Sir CHARLES TREVELYAN: What of those who have not the means of serving for nothing?

Colonel ROBERTSON: There are, of course, many poor men who would make excellent Officers, but who are deterred from entering the Army because the pay is small, and the style of living, expensive. But there is an abundant supply of Officers who are able and willing to perform their duties for the present rates of pay, and I do not see any reason to suppose that duty would be better done if the rates were raised. On the contrary, I feel quite certain, that it would be worse done supposing the pay was high and the Army principally officered by men whose chief object in seeking for commissions, was to realize a good income. In time of war, a rich man who prefers a life of risks and hardships to a life of ease and pleasure, proves that his heart is in his work. The presumption is that he will prove a good Officer. In time of peace a poor man, who accepts a low rate of pay, who practises great self-denial, and submits to many mortifications for the sake of obtaining military rank, also proves that his heart is in his work. Thus, whatever may be the disadvantages of the present constitution of the Army, that constitution has at least this advantage, that the terms of his service necessarily establish a presumption, that every Officer who accepts a commission, whether he be a rich man or a poor man, feels an interest in military duties, and has his heart in his work.

The CHAIRMAN: In inviting discussion I must remind you of the rule laid down by the Council, that each gentleman is allowed ten minutes.

Colonel OUVRY: I should like to make a remark upon that last observation of Colonel Robertson, concerning the "Officer who serves for nothing, who is so rich that he is able to serve for nothing, and that he makes a better Officer than others." I ask any person who has had experience of what happened in the Crimea, or in India, whether those Officers who are possessed of much money are the best Officers, whether they do not always fall off in times of trouble, and whether it is ever possible to get Officers who have money to continue to serve under circumstances of hardship and difficulty? I say they never will serve, you cannot depend upon Officers of that sort. If we had to fight a battle in Hyde Park we should never get more gallant Officers, but when they have to face hardships, with no fighting, no delicate food, no comforts, we know that generally speaking, after they learn what the discomforts and privations of war are, they apply for leave, and if that is refused, they request to sell out. I ask any person who knows anything of the past whether numbers of Officers did not do so, both in the Indian mutiny and in the Crimea? and also whether in the French army, large bodies of Officers ever send in their resignations, or send in applications to leave the army in time of war? Again, I ask those who know anything about the affairs of the Peninsular war, who were the Officers who fought and conquered in that war? Were they men of large fortunes? I recollect having a conversation with one old Captain; he told me he was tried as to whether he was a gentleman. After that war was over, a great number of Officers were brought before a committee and were questioned. They asked them "Who is your father? where does he live? what is he?" There may be Officers in this room who remember the facts, but I say, speaking from my own personal knowledge of what happened in the Crimea and in the Indian mutiny, I know that what I say is true. Officers will rush in at first, but if the war continues, you will not be able to get one. It is always the case. I have two relations, who were in the Peninsula, they were both put on half-pay after the war was over. They both of them got cadetships, and one rose high up in the service of the East India Company. I say if these men had been men of large fortunes, would they have gone into the Indian service? Certainly not. The question is whether you are to have an aristocratic or a popular army. I say that all these papers and pamphlets which we have read lately, have some excellent things in them; no doubt, the pamphlets of Sir Charles Trevelyan are most excellent, but the great mass of them go no further than tinkering and patching up. What we want is a thorough reform, and that reform is simply to popularize the Army; that is my idea of the subject.

An OFFICER: How would you popularize the Army?

Colonel OUVRY: I would do away with the purchase system, and I would thus popularize its ranks.

Sir CHARLES TREVELYAN: I am sure that we must all feel our obligation to Colonel Cunningham Robertson for the assistance he has given at the present stage of this great national controversy. While Parliament is officially discussing the Irish Church, people are thinking a great deal more about the Army, and are only waiting till the Irish Church is got out of the way to enter upon the practical settlement of the question. In the present stage of the discussion, Colonel Robertson has performed a useful public service by comparing, with great industry and skill, all the proposals which have been made on the subject. He has not had time to tell us the whole that he had prepared, but I hope he will give it to us in print, so that we may read it at our leisure. I will only touch upon two or three of the points alluded to by him.

I do not think Colonel Robertson fully appreciates the real objection to conscription. What took place at the commencement of this century furnishes the solution of the question. When we were threatened with invasion from Boulogne, it was universally considered necessary to have, what was called in the language of the day, a levy *en masse*. The whole able-bodied force of the country was to be organized. The enrolment actually took place, parish by parish, but in the meantime it was considered desirable to try what could be done by volunteering. So, more as a supplementary arrangement than for any other purpose, Volunteers were called for, and they came forward in such great numbers, amounting soon to two, three, four hundred thousand, that the levy *en masse* was set aside, and was no more thought of. The public sentiment entirely accepts the principle that every man's service is due to his country when it is really wanted. But this is a highly organized country in an industrial point of view. Our financial, commercial, and manufacturing system is of a very complex character, and, on the simplest principle of the division of labour, it is best for all parties that those who are so circumstanced that they can easily leave home, and give themselves up to the defence of the country, should do so, and that those who are occupied in carrying on the business of the country should remain at their desks, and in their manufactories. Conceive what the result would be if the 500,000 conscripts proposed by Colonel Robertson to be enrolled, were actually called out. Who would they be? They would be taken from the public offices, railways, telegraphs, manufactories, from industrial establishments of all sorts, their withdrawal from which would throw the social and political system of the country into utter confusion. It is far better that the whole country should unite in paying whatever may be necessary to send to the front that portion of the youth of the country which can best be spared from carrying on the ordinary business of the country.

Next, I am surprised to hear Colonel Robertson object to educated, intelligent soldiers. In order to get the requisite number of soldiers, we must draw upon the educated classes. Happily for our country and for its prospects, the uneducated, reckless classes from which we have hitherto drawn our soldiers, are becoming scarce, they are becoming totally insufficient to meet the demand. So, quite irrespective of the question whether educated or uneducated men make the best soldiers, it is positively necessary, in order to get the requisite number of soldiers, that we should call to our aid the classes who have been educated in national schools, and who form the bulk of our agricultural labourers, artisans, manufacturers, as well as of the persons employed in the police, on the railways, and in various other occupations of that sort. And in order to attract these great classes, which are far more numerous than those which now fill the ranks of the Army, we must make the Army a career for them, and furnish them with adequate motives. That educated, intelligent men, like our Volunteers, are more easily disciplined and handled than uncultivated clowns, and are animated by more patriotic feelings will, I am sure, be admitted.

Colonel Robertson justly pointed to the Militia as the key to our system of national defence, and the public sentiment is settling upon this basis. Now, there are two great defects in our Militia system. The majority of the gentlemen now present are better able to judge than I am, yet I believe I am speaking the truth when I say that the great defect of our Militia is, that they are not sufficiently trained. The twenty-one days' training in each year, with the few additional days for drilling the recruits, are totally insufficient. If it is repeated year after year for twenty years, it still fails to turn out a properly trained soldier. And if this has been so hitherto, how much more now, owing to the introduction of arms of precision and rapidity, and the improvements in the exercise and manœuvres of troops—trenching—loose order, and so forth, all which require careful, continuous instruction. The twenty-one days' training are now quite insufficient. Therefore, I propose that the whole of the regular Army,--Militia, as well as Line,—should go through at least one complete year's training.

The other great defect is, that the Militia is not connected in any proper relation, with the other forces of the country. From the Volunteers, of course, it is entirely separated. Even as regards the line, with which it has more in common, professing to be of the same character, yet the two forces, the Militia and the Line, are at present rival forces. They compete against each other in the recruiting market; and when the Militia is called upon to serve as a reserve to the Line, it is only by weakening the Militia and furnishing trained men, against the grain of the Commanding and other Officers, that it can be done. For this and other reasons, which have been fully explained in my recent pamphlets, I would combine the Militia with the Line in a regimental organization, so that they should be localized and united, by making the regiment of the Line, which is most connected with the district, and the local militia regiment, and also in a secondary degree, the local Volunteer regiments, battalions of the same regiments; having at the head-quarters of each district, a depôt battalion common to all, which should train the recruits both for the Militia and for the Line. I would make the first engagement always for one year; and at the end of the year, the young soldier should have his choice of returning to civil life, with a ten years' engagement in the Militia, to come out for a few days, now and then, for divisional manœuvres, or of joining the Line or general-service battalion of the regiment, with a seven years' engagement, returning at the end of that time to the Militia for a further period of ten years. In this way there would be only one machinery for supplying trained recruits to both Line and Militia, and the two forces would be combined in one organization.

But the main point of all, and the only remaining one upon which I will make any observations, is, whether, according to this system, we can get a sufficient number of recruits. In order to get recruits on the one year's engagement, I rely upon the general popularity of the military service, and upon the prestige of the military character. The young men would come at an early age, for even at the age of 18, our young men are quite old enough to be trained; and they would engage, knowing that at the end of the year, if they did not like the Army, they could return to civil life. But at the year's end the great difficulty would have been got over. As Baron Dupin observed, "the difficulty is not to induce a soldier to remain when you have once "trained him, but to detach him in the first instance from his home and home associations." Therefore, I would make the first stage of the military career very short and easy. And I believe that the spirit which brings an unlimited number of young men into the Volunteers would, to a great extent, be diverted into this channel.

The military spirit of the country now finds its vent in the Volunteering system. I believe that if a system such as I have sketched, were established, the same spirit would bring large numbers of young men into the Depôt Battalions at the County towns. It would not be a strange community into which they would be introduced. On the contrary, the local Depôt Battalion would be filled with their own relations and friends. It would also be filled with men who had seen foreign service, and were holding comfortable and respectable positions in the depôt battalion as instructors. The young men would also have before them the example of numerous persons from the neighbourhood, and probably from their own village, and from among their own relations, who had risen to respectable positions, both in the military and civil service. As Colonel Robertson has remarked, seven years' general service at home and abroad, the performance of this share of hard national service, should entitle men to some positive advantages. First of all, there would be the advantage of returning to the *cadre* of the regiment, the depôt battalion, and becoming instructors to the regiment. Then, there would be, according to my view—I will not now enter upon the argument, except to say that military promotion must always be taken in connection with the new motives by which new and better educated classes are proposed to be attracted into the Army—a certain fixed proportion of military commissions in each regiment appropriated to the most deserving and best qualified of the young men. But, above all, the whole of our great Civil Service should be thrown open to the extent to which the men might qualify themselves for it. That element alone would accomplish the object. If our Customs, Excise, Post-office, Police, and all the other departments, were thrown into the scale, that alone would make the Army a popular profession.

Captain Vaughan: Would Colonel Robertson kindly allow me to put a question with regard to appointing subalterns from the line to fill the place of subalterns in the Militia? The Captains would remain in the Militia as at present, and no more subalterns would be appointed, but subalterns would be sent from the Line?

Colonel Robertson: Only for the training for a month.

Captain Vaughan: The question I wish to put upon that is, would you offer an inducement to these Officers to go to the Militia, or would you order them to go?

Colonel Robertson: I would order them to go. If there was any little expense incurred in moving, I would pay for that, but I would order them to go.

Captain Vaughan: I was inclined to dispute that part of the question.

Colonel Robertson: I would not put them to that expense.

Captain Vaughan: But I think very few subalterns from the Army would be willing to serve under Officers of far less experience than themselves, as the Captains of Militia would be. There is one more point I would allude to, in fact two points. One is that the Militia, during the Crimean war and elsewhere, were insufficient to fill up the battalions of the Line, or be of any use beyond garrisoning the Mediterranean stations. As proof of that I may adduce the fact, that at that time we were obliged to recruit for mercenaries throughout Germany. There is another grand objection to the Militia, and that is, it is liable for service in England only, and not for service abroad.

Lieutenant-General Lord Templetown: On the question of conscription I wish to say a very few words. I do not agree with the Officer who has addressed us this evening, nor do I disagree with him. But to explain myself, I will say that for a defensive army I would have conscription, but not for an Army of action out of the country. I should hardly have thought it worth while to address you upon this subject, had I not rather strong authority. I may say with Horace,—*Non meus hic sermo est*. But my preceptor was no ignoble one, for the opinion which I have just given you I heard from a personage whose loss we all deeply regret, and whose character we all highly value. I mean the late Prince Consort. I was in attendance upon him on duty once at Aldershot, and had the honour of accompanying him in his ride; and his Royal Highness made that remark which I thought most valuable:—I think the country may well demand of every patriotic man his services in case his country is attacked, and I think it might be carried out by conscription; but as to the general services of the Army in our colonies and elsewhere, although they uphold and carry forward the honour of our country, yet I do not think the conscription is so essential in that respect. I am quite sure you will think it worth while that I should have communicated to you this opinion, which must have value in your judgment of the matter under discussion.

Colonel Robertson: Lord Elcho and Colonel Baker only advocate conscription for the defensive army, the same as Prince Albert. It is merely the principle they want to establish.

Lieutenant-Colonel Leahy, R.E.: I will first refer to what Lord Templetown has just said as conveying the views of Prince Albert; with respect thereto, I would observe that I do not think it would be found in the history of this kingdom, that the people of England have ever failed to come forward for the defence of the nation against invasion. The difficulty in recruiting our forces has arisen in respect of our offensive and colonial Army, and not of our defensive Army. I think, therefore, with Colonel Robertson and others, that conscription may be set aside as a necessary part of our organization. Nobody proposes it for the offensive Army, and for the defensive Army, we do not want it. I, therefore, consider that any scheme of organization should be based upon the volunteer system.

There is another part of our military system, which, so far as I know, has never failed; that is the regimental system. I therefore think that in plans for the organization of our offensive forces, we should adhere to the regimental system, and attempt to expand it. I think the manner in which we now fail is, that we have got regimental *cadres*, varying in strength from 500 to 1,000 men, the number of men being altered according to the views of the Cabinet of the day, but we have no machinery, or men in reserve, and easily made available to raise the regiments to their maximum strength. I think that these reserves ought to be under the control of the Commander-in-Chief, as distinguished from the civil control, to which the Militia and Volunteers are subject. I have felt great diffidence in giving opinions on this subject, but struck by the admirable arguments of Lord Grey before the Recruiting Commission, I could not help putting forward (early in 1867), the details of a system by which I thought the reserves of the offensive forces might be tacked on to the present regiments. I think there are many reasons in favour of this plan. My reason for not proposing to attach regiments of the Line to regiments of Militia, was that the Recruiting Commissioners reported that it would not be "a desirable or expedient course" to localize regiments. I do not now see how you are to carry out the localization of regiments, especially in the case of regiments recruited in Ireland, and in the present mood of that country. I think our system ought to provide for establishing local connections, without localizing regiments. One of the advantages of the system which I proposed is, that regiments could have local connections in different parts of the country without being necessarily quartered in these localities for any length of time.

I now pass to the question of length of service. We want to get more men, and I think it is admitted by all that short service is the way by which we are to get more men, and that by means of short service we shall popularize the military service, and have a larger proportion of men trained to arms. That the proposition is economical I have attempted to prove in my paper, and I do not think the calculations have been controverted. A short service man, when you take into consideration the pension, costs half of what a long service man does. I do not advocate the payment of bounty, but as a matter of economy it would be cheaper to pay a short service man £200 bounty, than to re-engage an old soldier. That is the financial view of the question.

An OFFICER: Particularly if he deserted next day.

Colonel LEAHY: I do not suppose either to desert. I entirely agree with what Sir Charles Trevelyan has now said, that the first stage must be made very short and very easy; anything that lengthens the term of enlistment beyond what is necessary for training, will destroy the benefit of the system of short service. Seven years is neither one thing nor the other. In enlisting the soldier I would give him every facility for returning to civil life, subject to service in the reserves. All we should require is, that he should serve continuously until he qualifies as a soldier. And even that I would not insist upon, if, as in Prussia, he was allowed to pay his own way. In the Prussian service, young men may volunteer to serve for one year without pay, and at the end of that year, they may go. I would introduce the same system. If a man wished to go after one year, and paid his expenses, I would let him do so.

If a soldier wished to stay after the short-service period, and was required for service abroad, or for colonial service (the length of that colonial service in my opinion is more a medical question than any other, and depends on the number of years for which men can serve, without special detriment to health, in the climate to which they are detached; in India this, I believe, is from seven to ten years), I would add the period of colonial on to the first period of service, and thus make up the long service. After that, I would make continuance in the Army dependent upon the utility and good conduct of the individual. I think the system of deferred pensions should also be kept up, because I do not think the vacancies in the civil service would afford sufficient inducement to service in the reserves. I would, therefore, hold out deferred pensions at the end of fifty or sixty years of age. I think you will have to retain some such inducement to get the number of reserve men you want. I would add a few words with regard to the article in the *Times* to-day. The writer gives people who have written on the subject of Army reform credit for having thought of it from one point of view. He says one person takes up fortification, another the Navy, another the organization of the forces. I think we ought not to get the credit of looking upon the subject from such small points of view. It is utterly impossible in a paper read in this Institution to take up everything, and, while dealing with one point, we ought not to get credit for having overlooked the others.

Captain COLOMB, R.M.A.: With your permission I will make a few remarks with reference to what has fallen from Colonel Leahy in connection with the paper before us. I allude to the question of localization and to the question of colonial service. Colonel Leahy has mentioned the fact that in a paper read in this Institution, it is impossible to go into the whole question of what is necessary to be done for our Fleets and Armies. Still, I think his remarks have a bearing upon the question of colonial service. One of the objections I gather from Colonel Leahy's observations is, that it is impossible to localize troops on account of the requirements of colonial service. After all it comes back to the question, what do you expect your Army to do for the colonies? If you expect your Army to hold all the British possessions abroad, well and good. Then, localization is impossible. But it appears to me that the colonies in time of peace have very little to do with the Army.

Colonel LEAHY: I did not put it upon that ground. I said you could not localize regiments in Ireland.

Captain COLOMB: I beg your pardon. It just shows the danger that we are liable to fall into by taking up too limited a part of the question. It appears to me that to consider and discuss the question of the organization of the Army off-hand, without first considering upon what that organization is to rest, is a mistake. I think it was Sir Charles Napier who said that success in war mainly depended upon two great principles; which were, "to be in the right place at the right time." Now, it is the business of distribution to determine what is "the right place," and it is the function of organization to secure "the right place" being filled "at the right time." Now, there are many representatives of particular schemes of organization in this room, and if we all gave our opinions we might agree in some things, and we might disagree in others. But I believe the key of the whole question of military organization rests really upon a question of distribution. Any person who disputes Sir Charles Trevelyan's arguments with reference to localization, must immediately fall back upon the ground that localization is impossible, owing to the duties that our armies have to perform in the colonies. If you can remove that part of the question, put the colonial service aside, the question will be very much simplified. I will not go into the arguments about the colonies, but I will say this, that there is plenty of ground and plenty of authority on the side of those who advocate that the foreign service of our active embodied Army in time of peace should be limited to India and the road to India. Having once established that principle, a great number of the difficulties of organization vanish. Well, supposing the foreign service of our Army in time of peace to be limited to India, the next question is, in time of war, what would you require your Army to do? Because upon that depends the strength of your Army. You must estimate its strength by what that army will be required to do in time of war. It would be impossible to go into the whole question of what effect an American war would produce, or a Russian war would produce, or a French war would produce. It is sufficient to say that we should require a very large Army; and that we should require an army of reserve to reinforce and become part of the active Army, available for service not only in England, but wherever they might be wanted. I will now come to the question with regard to localization. That distribution would admit of localization; therefore the difficulties, resting upon the ground of distribution in opposition to the possibility of localization, cease. And if localization is possible on the ground of distribution, I think it will appear, upon consideration, that it is a principle which is necessary to be incorporated with our army system, if short service, as it must be, is introduced. It would be impossible to give all the reasons for this. At all events, we are all agreed upon one thing, that it is necessary to offer all the inducements we can to men to enlist, whether for short or for long service. Now, take the case of a non-localized service, take the case of a non-localized corps with long colonial service; what are the inducements you offer to men to come into it? They appear to me to be these, and they are easily gathered from Sir Charles Trevelyan's pamphlet, which I have summarized. You offer a man, as an inducement with this long colonial service, expatriation to begin with. Then, he is to remain a single man, or he is to exist in a state of married misery. The next thing you offer him is severance from his family, and from his ocal and civil connections. And the last thing you offer him is idleness, which is he root of all mischief. Take the case of a localized service; there is no hindrance o a man getting married. If your periods in the Army are short, your periods on oreign service must be short. Therefore, it is no hardship to a man to be separated rom his wife for a short time; the expense of removing the wife does not enter nto the question, therefore a man may marry when he chooses without the military uthorities exercising any control. Short service, of course, does away with expatriation. Thirdly, with short service you offer a man a fixed home. Fourthly, you fford him the opportunity of adding to his soldier's pay by working at a trade, both or his own benefit and for the benefit of the State. Everybody knows what a non-ocalized service is, what its inducements are, and what the life is. A localized ervice is not so well understood, because there are few instances of the kind. I will therefore briefly wind up by describing a service of about 3,000 men, half of whom are perpetually abroad. Their period of service abroad averages three years and a half, Officers and men. Therefore, you have about 1,500 continually at home. You may call it one battalion abroad, and one battalion at home, if you like. The men at home by being fixed, and having families, and keeping up their local connection, are enabled to make all the articles of clothing, except boots, and could make all the boots and appointments of the whole regiment at a considerably reduced cost. That is an advantage to the Government, and it is a considerable advantage to the men. And not only that, but by localization you have the power of employing your men at trades, and of utilizing their labour under the control of the Government for the purposes of the State. I do feel this—the more the question is ventilated, the more the whole subject is gone into—that localization and short service are in reality the two fundamental principles in Army Reform, which must be carried out.

The Chairman: Now, Colonel Robertson, perhaps you would like to reply.

Captain Burgess: I should like to ask one question. Colonel Robertson says, "that during peace the appointment of subalterns to regiments of Militia be "discontinued, and during the annual training their duties be performed by sub-"alterns detached from regiments of the Line." I should like to know whence he is to get subalterns for the Militia regiments, when war breaks out?

Colonel Robertson: I am not prepared at present to offer any suggestion as to the best means of providing subalterns for Militia regiments when embodied for actual service. My observations merely referred to the existing state of things. I look at the Army list, and where lists of subalterns of Militia ought to be, I find nothing but asterisks. I ask the reason, and am told that properly qualified persons cannot be found to accept these commissions. But I feel persuaded that the prospect of a war would cause this difficulty to vanish—there would be an abundance of applicants, and four months' training would suffice to convert those selected into excellent Officers. In time of peace not only is it practically impossible to find properly qualified persons who will accept subaltern's commissions, but if this difficulty were overcome, we should have a still greater difficulty to contend with. In time of peace we have not the means of instructing militia subalterns in their professional duties. I therefore do not see any means of obtaining the services of well-trained subalterns in time of peace, when Militia regiments are assembled for the purposes of instruction, excepting by borrowing them from line regiments. I think it will be admitted that this expedient is better than the present state of things; but of course if means can be found to induce gentlemen to serve in Militia regiments as subalterns on the same terms as the Captains serve, and to attach themselves to regiments of the Line, until properly instructed, this will be better still. As regards Colonel Ouvry's remarks concerning the derelictions of duty with which he charges those Officers who invest money in the purchase of promotion, I do not know that I can make a better answer than to appeal to his own personal experience.

Colonel Ouvry: Do you dispute the facts?

Colonel Robertson: I do not dispute the facts, but the answer I wish to make is, that I do not think they establish the inference you draw from them. I shall mention the names of two Officers, both personally known to Colonel Ouvry, as well as to myself. One of them, Colonel ———, served in my own regiment, the 8th, through the whole of the Indian mutiny; the other, Colonel ———, served in Colonel Ouvry's regiment, the 9th Lancers, and was killed at the siege of Delhi. Both of these Officers, as Colonel Ouvry well knows, had expended large sums of money in the purchase of their commissions. I ask him if he ever knew, if he believes that in the whole Army it would be possible to find Officers who were more zealous and assiduous in the performance of their duties, more devotedly attached to the service than the two I have named? Both had strong inducements to leave the Army, one of them had sufficient private fortune to enable him, had he wished to do so, to live a life of ease and pleasure at home. The other had invested nearly the whole of his means in the purchase of promotion, and he had a wife and children for whom, if the money so invested were lost, he could make no adequate provision. But did either of these Officers desert his post?

Colonel **Ouvry**: Hundreds did so.

Colonel **Robertson**: Hundreds may have done so, but if, after a brief experience of the fatigues and dangers of a campaign, there are always a good many rich Officers who desert their posts by selling out, are there not always a good many poor Officers who would be glad to follow their example if they had the means of doing so; and of these unwilling soldiers, are there not always a few who under various pretences manage to evade their duty quite as disreputably to themselves and much more injuriously to the Service, than if they had sold their commissions? In time of war an Officer is worth nothing unless his heart is in his work, and it is extremely probable that the proportion of poor Officers who serve unwillingly, and only because necessity compels them to do so, is quite as great as the proportion of rich Officers who sell out because they prefer safety and ease to hardships and duty. Do not therefore let us suppose that the quality of our Officers would be improved if we could devise some arrangement which should render every Officer dependent on his pay, and prevent any Officer from leaving the Service, however inconsistent he might find it with his domestic duties and private interests to remain in it. As to the general question, how are we to get good Officers? Do not suppose that any method of selection, any rate of pay, or any system of training will make, I do not say all, or the majority, but more than a small minority, really good Officers. Sir Charles Trevelyan's plans all hinge on the idea that it is possible, by means of selection and training, to get a body of Officers, each of whom shall be thoroughly efficient, and to all of whom it is desirable to offer such advantages as will make it the interest of every individual Officer to devote his life to the performance of military duties. A certain proportion he would promote from the ranks, and the remainder he would take from the public schools, and have them specially trained at military colleges, so as to make them professional soldiers. Now I think that this method of constituting a corps of Officers is erroneous in principle. In order to get a really efficient body of Officers, you must regulate the duration of their term of service in the same manner that Sir Charles Trevelyan recommends you to regulate the term of service of private soldiers. Inducements to prolonged service must be offered only to the select few; the duration of the service of the remainder must be limited to as short a term as circumstances will admit of. Supposing it to be practicable, the best possible arrangement for the interests of the State would be to limit the first commission of an Officer, like the first engagement of a recruit, to a short term of years, at the expiration of that term, to pick out a sufficient number of the best, to provide for vacancies in the command of regiments, to grant those picked men new commissions, and to discharge the remainder. But if considerations of economy, or the adverse interests of individuals, rendered it impossible to secure for the State the option of discharging Officers after a short term of service, care ought at least to be taken so to regulate our Military Institutions as to provide motives which favour voluntary retirement, and to eliminate motives which favour prolonged service. Although I am strongly opposed to the purchase system, yet I think that by facilitating early retirements, it is more beneficial to the interests of the State than such a system would be as that proposed by Sir Charles Trevelyan, which makes it the interest of every Officer to devote his life to the Service. If Officers, instead of being promoted by seniority or by purchase, were selected for the command of regiments on account of their possessing special qualifications for command, this mode of promotion, besides securing picked men for performing the important duties of the superior regimental ranks, would also have the effect of driving off the chaff. It would be even more efficacious in promoting early retirements than the purchase system.

Colonel OUVRY: You do away with purchase, then?

Colonel ROBERTSON: Undoubtedly I should like to see purchase done away with, but only on this condition, that the system of promotion substituted in its place provided some effectual means for selecting picked men for the command of regiments. This I consider the essential and indispensable condition of any real improvement in our regimental organization. I would rather a thousand times have purchase than seniority. The Artillery, in which promotion goes entirely by seniority, I consider a dead and lifeless service. It is slower, and has less vitality than the Line. I am an uncompromising opponent of purchase, but there is no scheme proposed as a substitute which I consider so much better as to be worth the inconveniences of a change of system.

Sir CHARLES TREVELYAN: I would train our Officers and I would pay our Officers as if they were to follow the profession to the end of their days; but I have that reliance on the military spirit of our people, and upon the habit that our young aristocracy have formed of pursuing the military profession during their early leisure years, that I am confident that practice will go on even more than ever; and in proportion as we raise the standard of our Officers' qualifications, we shall get a better supply from that class.

Colonel ROBERTSON: As far as I know, I do not know any one that is in favour of purchase. Colonel Baker is dead against it.

Sir CHARLES TREVELYAN: You were speaking of selection, and I did not see how you squared it, hence my remark.

Colonel ROBERTSON: No one defends purchase, but many who disapprove of it confess that they have nothing better to propose. The only scheme that came before the Royal Commission of 1857, which had any pretension to deal adequately with the difficulties of the subject, was that proposed by Sir Charles Trevelyan. If that scheme had been adopted, it is true we should have got rid of purchase, but what should we have got in its stead? We should have got seniority, which I think more pernicious than purchase, and we should also have got promotion from the ranks, which I think still more pernicious than seniority. After carefully reading Sir Charles's scheme, I said to myself in despair, if the only choice is between this scheme and the old system, for God's sake let the old system remain. Subsequent consideration of the subject has, however, strongly impressed me with the idea that it is quite possible to relieve the Army from the evils of the purchase system, without inflicting upon it the worse evils of a seniority system, combined with a system of promotion from the ranks, and also without adding a single sixpence to the Army Estimates. How this may be done, I have endeavoured to explain, in a paper on "The Appointment and Promotion of Regimental Officers," published in the twelfth volume of the Journal of this Institution. The great difficulty is to find some means of abolishing purchase without causing a stagnation of promotion. Without purchase, how are you to secure tolerably rapid promotion?

Colonel OUVRY: By compulsory retirement.*

Colonel ROBERTSON: Compulsory retirement would be expensive; and to make it worth the money it would cost, you must combine it with a system of selection. It is not sufficient that the Commanding Officer of a regiment should be young. He should also be a picked man. He should be zealous, energetic, intelligent, and thoroughly trained. Compulsory retirement will create vacancies, but it will not help you to fill them up. It is only by means of a system of selection, such as that which I had last year the honour of submitting to the members of this Royal Institution, that the State can make sure that any money which may be spent to create vacancies will secure the promotion of Officers worth the outlay—of Officers to whom, on account of their natural capacity and the special training they have received, it is for the public interest that the command of regiments should be given at an early age. It is admitted to be essential to the efficiency of a regiment that the adjutant and the sergeant-major should be picked men. It is surely still more essential that he who selects and controls the adjutant and sergeant-major, should be himself a man of more than average ability; that he should be one of those men endowed with a special aptitude for command, who even when placed in a subordinate position, practically control and direct their superiors. Superficially considered, promotion from the ranks might be believed to be a system based on the principle of selection, but in reality it is diametrically opposed to it. Officers promoted from the ranks are no doubt the best men of their class. They are excellent soldiers; but to suppose that an excellent soldier possesses the qualifications requisite to make a good Officer, is an error of the same kind as to suppose that an excellent attorney's clerk possesses the qualifications requisite to make a good judge.

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* [These further remarks are added at Colonel Ouvry's request.—ED.]—I am further of opinion that promotion from the ranks is the only proper mode of officering the Army, but not from the class which now prevails in them—indeed any Commanding Officer would tell you that he has very great difficulty in finding Non-commissioned Officers. Of course to think of promoting men from the ranks as now constituted, would be simply absurd. But if it were known that the ranks were a certain stepping-stone to a higher position, the sons of clergymen, county gentlemen, and others would enlist, and thus the character of the whole Army would be raised; a few educated men in the ranks would leaven the whole mass, and we should have, if not so rich, certainly a more efficient body, who, depending on the Army as a profession, would have no inducement to fall away in the time of difficulty and privation.

The CHAIRMAN: I am sure that you will allow me to return your thanks to Colonel Robertson for his very valuable address.

APPENDIX.—Vide p. 478.

Classified Summary of Suggestions made by various Writers and Speakers for the Improvement of our Military Institutions.

A. Enlistment.

I. Suggestions relative to mode of enlistment.
II. Suggestions relative to duration of the Military engagement.
III. Suggestions relative to inducements to voluntary enlistment and to increasing attractions of military service.

B. Organization.

I. Suggestions relative to command and superintendence.
II. Suggestions relative to the constitution and mutual relations of the tactical and administrative divisions of the forces.
III. Suggestions relative to the appointment and promotion of Officers.
IV. Suggestions relative to territorial distribution of troops.

C. Training.

Suggestions relative to military training, individual and collective.

A I. ENLISTMENT. *Suggestions relative to the Mode of Enlistment.*

GENERAL CONSENT. All writers and speakers consider that, in time of peace, voluntary enlistment is the only practicable mode of recruiting the regular Army.

The advantages of voluntary enlistment are well and briefly stated by Colonel Baker at p. 26 of his pamphlet on Army Reform.

Lord ELCHO suggests that 5,000 young men in their twentieth year should be selected by ballot for five years' Militia service.—(Report of Debate, *Times*, 11th June, 1869.)

Colonel BAKER suggests that 500,000 men should be drawn by ballot from a list including the whole male population between eighteen and thirty, and that each of these 500,000 men, unless he provide a substitute within twelve months, should be liable to a second ballot, to supply vacancies in Militia regiments,—(Army Reform, p. 41.)

Sir J. BURGOYNE points out that the formation of a strong Reserve of trained soldiers is incompatible with a system of voluntary enlistment.—(Our Defensive Forces, p. 17.)

Lieutenant-Colonel BANNATYNE thinks that the Army, as at present constituted, is composed of that class of the population best adapted for military service. The Militia, he thinks, should be exclusively composed of agricultural labourers and town artisans, and married should be preferred to single men.—(Our Military Forces and Reserves, by Lieutenant-Colonel J. Millar Bannatyne, 1867, pp. 5—19.)

Mr. CARDWELL disapproves of ballot.—(Debate in *Times*, 11th June, 1869.)

A II. ENLISTMENT. *Suggestions relative to Duration of Military Engagement.*

Mr. CARDWELL thinks it desirable that the military engagement should be long; that it should be divided into two periods; the first in the line should be as short as possible, the remainder in the reserve.—(Debate reported in *Times*, 11th June, 1869.)

H. COLE, Esq, C.B. Soldiers required for permanent military duty in India to be enlisted for seven years. Men required for permanent military duty at home to be enlisted for twelve months, and then returned to civil occupations.—(Report of Meeting of Society for the Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

Sir A. ALISON, Bart. Twelve years, with right to re-engage for term necessary to complete total of twenty-one years. Soldiers of not less than seven, or more than ten years' service to be permitted to volunteer for five years' service in reserve.—(Army Organization, pp. 34 and 40.)

Lieutenant-Colonel BANNATYNE. Twelve years, with right to re-engage for term necessary to complete total of twenty-one years' service, but that practically the total compulsory service with the colours should be reduced to about fifteen years, by means of a scheme for a Reserve force, which he indicates.—(Our Military Forces, &c., pp. 71, 73.)

Sir J. Burgoyne. Six years for home service; twelve years for East Indies and the Colonies.—(Our Defensive Forces, p. 16.)

Colonel Baker. Maximum fourteen years, minimum four years. None excepting non-commissioned Officers to be permitted to re-engage. The Militia engagement to impose liability to be drafted into line regiments in time of war.—(Army Reform, pp. 29 and 38.)

Lord Elcho (approved by Sir Hope Grant). Twenty-one years, divided into three periods of seven years each:—

1st Period. Continuous military duties either at home or abroad.

2nd Period. During peace, periodical training; during war, liability to continuous service, either at home or abroad.

3rd Period. During peace, training to be limited to a few days in the year; during war, exemption from liability to foreign service.—(Letter in *Times* 16th February, 1869.)

Lord Monck. Twenty-one years, at the end of second year, each recruit to have the option of completing the remainder of his term of service, either in the Line or in the Militia. During war, all Militiamen to be liable to general service.—(Report of Debate, *Times*, 24th April.)

Lord Northbrook. Twelve years; five continuous, and seven in reserve, or *vice versâ*.—(Report of Debate, *Times*, 24th April, 1869.)

Lord Grey. Engagement to include a short term of service in the Regular Army, followed by a second term in Reserve.—(Appendix to Report of Recruiting Commissioners, 23rd August, 1866.)

Sir Charles Trevelyan. After one year's continuous training at a depôt, recruits to have the option of seven years' service in the Line, or of ten years' service in the Militia, terminable at six months' notice.—(British Army in 1868, p. 62.)

Lieutenant-Colonel Leahy, R.E. Three years, this followed by twenty-seven years' service in Reserve, to give a right to a permanent pension.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

The Duke of Cambridge recommends that the systems of long and of short engagements be tried concurrently, the recruit being allowed the option of enlisting for a long or for a short term of years.—(Report of Debate, *Times*, 24th April, 1869.)

Lord Norreys. Certain Militia regiments to be induced to volunteer for liability to foreign service, these regiments to receive extra pay and to be bound for a longer period.

A III. Enlistment. *Suggestions Relative to Inducements to Voluntary Enlistment, and to Increasing Attractions of Military Service.*

Sir Charles Trevelyan. Reduction of terms of engagement from twelve to seven years.

2. Abolition of the purchase system. Improvement of terms of

service of Officers, and promotion from the ranks of a certain proportion of the regimental establishment of Commissioned Officers.

3. Permission to Non-commissioned Officers, and a certain proportion of picked men, to re-engage and serve until superannuated on a permanent pension.

4. Rendering military service an indispensable condition for obtaining appointments in certain branches of the administrative departments of the Army, and of the Civil Service.—(Standing, or a popular Army, p. 14.)

Lord **Elcho**. Soldiers who engage for a second period of seven years' Reserve service to receive pay at the rate of 3d. or 4d. a-day; those who engage for a third period of seven years' reserve service to receive 6d. or 8d. a-day, and at conclusion of period, a pension of same amount for life.—(Report of Debate, *Times*, 11th June, 1869.)

Lieutenant-Colonel **Bannatyne**. Soldiers who re-engage in Reserve, to receive £6 per annum, permission to marry, and rations, and an allowance of 3d. per diem for wife, and 1½d. for each child when on permanent duty.

Pension to be granted after twenty-one years' service. Serving in Reserve to reckon not less than half Line-service, and a deduction to be made for each year's service abroad.

Soldiers in Line regiments to receive classified rates of pay, regulated according to proficiency.

Rates of pay to be increased when any rise takes place in the value of labour.

Sir A. **Alison**. Soldiers of seven years' service, who engage for five years' service in Reserve, to receive pay at the rate of 6d. a-day.

Soldiers of fifteen years' service, who engage in Reserve, to receive pay at 6d. a-day, and after six years' service a permanent pension of same amount.—(Army Organization, pp. 34 and 41.)

Lieutenant-Colonel **Leahy**. Soldiers who re-engage for Reserve-service to receive £8 per annum, and on completion of thirty years' service (of which three years are to be in a Line regiment) a permanent pension.—(Journal of Royal United Service Institution, vol. xii. No. 50.)

Lord **Monck**. Abolition of purchase and substitution of Sir C. Trevelyan's scheme.

Reserve soldiers to be remunerated by small annual retaining fee (amount not specified).—(Report of Debate, *Times*, 24th April, 1869.)

Lord **Northbrook**. Soldiers to be taught trades. Vacancies in certain departments of the Civil Service to be filled by men who have completed a term of military service.—(Report of Debate, *Times*, 24th April, 1869.)

Lieutenant-Colonel **Baker** estimates that a bounty of £5 would be sufficient to induce men to enlist in the Militia for a period of five years, subject to the condition of liability to be drafted into the Line in time of war.—(Army Reform, p. 59.)

The **Duke of Cambridge** thinks that the promise of pension is the chief inducement which attracts recruits.—(Report of Debate, *Times*, 24th April.)

Mr. **Cardwell**. 1. Pensions to be granted to Non-commissioned Officers and a certain proportion of picked men.

2. Civil patronage to be made subservient to procuring recruits.—(Report of Debate, *Times*, 11th June, 1869.)

H. **Cole**, Esq., C.B. When lads leave school, every inducement to be given them to elect between joining the Militia or becoming Volunteers. A certificate of having served well in the Line, Militia, or Volunteers to be a necessary qualification for obtaining civil employment.

Payment and pensions of troops required for permanent service, to be liberal in time of war; in peace to be regulated by rate of wages and necessities of case.—(Report of Meeting of Society for Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

B I. ORGANIZATION. *Suggestions relative to Command and Superintendence.*

Lord **Northbrook** declared that it was the policy of the Government to establish a uniform system of command, administration, and supply for all branches of our military forces.—(Report of Debate, *Times*, 4th April, 1869).

Mr. **Cardwell** stated that the regular Army, Militia, Yeomanry, Volunteers, and every other description of military force, would be placed under the control and superintendence of the same Staff.—(Report of Debate, *Times*, 11th June, 1869).

Sir A. **Alison** suggests that every description of military force should be placed under the direct command of the Commander-in-Chief, acting through Generals and Staff Officers appointed by him.—(Army Organization, p. 57.)

Lieutenant-Colonel **Bannatyne** considers unity of command and administrative simplicity to be a necessity, and suggests that the Militia should be placed under the effective superintendence of General Officers commanding districts.—(Our Military Forces and Reserves, p. 59.)

Lord **Elcho** suggests that special Inspectors should be abolished, and that the Militia and Volunteers be placed under the supervision of the General Officer in command of districts.—(Debate reported, *Times*, 11th June, 1869).

Lord **Monck** suggests that all descriptions of military forces should be placed under the same executive control, and the supply services of all descriptions of troops should be managed by the same administrative Staff.—(Debate reported *Times*, 24th April, 1869).

B II. ORGANIZATION. *Suggestions relative to the Constitution and Mutual Relations of the Tactical and Administrative Divisions of the Forces.*

Sir C. **Trevelyan**. Regulars, Militia, and Volunteers to be tactically incorporated and organized as battalions of composite county regiments.—(A Standing or a Popular Army, p. 14.)

Sir A. Alison. Regulars re-engaging in reserve to be incorporated with regiments of the line and local corps of Pensioners.

A local Indian Army of 40,000 men to be formed.

Battalions on peace establishment to be complete in Officers and in non-commissioned Officers. Strength of privates to be reduced one-half.

Militia and Volunteers never to serve in same brigade.—(Army Organization, chap. ii.)

Colonel Baker. Peace establishment of a battalion to consist of 500 privates, with full complement of Officers and non-commissioned Officers.

Militia to be incorporated with Line battalions for training during an annual autumn concentration in camps for field manœuvres.—(Army Reform, chap. v.)

Lieutenant-Colonel Bannatyne. Soldiers re-engaging for Reserve to be organized as a distinct force, separate from Militia, having a contingent of reserve attached to it, &c.

Mr. Cardwell. The Army to be small; the Reserve large. Troops of the Line, Militia, and Volunteers to be welded together and consolidated.

The Reserve of the Line to be distinct from the Militia. To be trained with the Line in peace, and incorporated with it in war.

A large number of weak battalions preferable to a smaller number of strong.

Complete *cadres* better than strong establishments.

Disapproves of a separate establishment for India.—(Debate reported in *Times*, 11th June, 1869.)

H. Cole, Esq., C.B. India to have a distinct Army. Home establishment to consist of one *corps d'armée* of 16,000 men, organized on Prussian principle, supported by a reserve of Staff Officers, Engineers, Artillerymen, Marines, Hospital Staff, &c., the strength of which is estimated at 30,000 men.—(Report of Meeting of Society for Encouragement of Arts, &c., 17th February.)

Lord Elcho. Volunteer brigades to be kept separate, and to be commanded by Volunteer Brigadiers.—(Letter to *Times*, 12th February, 1869.)

Lord Monck. Regiments for home service to consist of one service battalion of 500 men, with complete *cadre* of Officers and non-commissioned Officers, and a second or depôt battalion of 400 men. A sufficient reserve of trained soldiers to be borne on the books of each service battalion to raise its strength to 1,000 men.

Militia in case of war to be liable to be embodied for general service.—(Debate reported *Times*, 24th April, 1869.)

Lieutenant-Colonel Leahy. Soldiers who re-engage to be incorporated and drilled with regiments of the Line.

A regiment of the line to consist of one service battalion and one home battalion, having a contingent of reserve attached to it and borne on its muster rolls.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

Volunteers to be brigaded separately.

B III. Organization. *Suggestions relative to the Appointment and Promotion of Officers.*

Sir C. **Trevelyan** suggests that purchase should be abolished; that a certain proportion of all vacant commissions should be filled by promotion from the ranks; the remainder, by selection from the pupils of military schools.—(The British Army in 1868, p. 9.)

Sir A. **Alison**. Purchase to be abolished above the rank of Captain. No Officer who had not purchased, to be allowed to sell. Command of a battalion to be limited to six years, after which Colonel to have the option of retiring on full-pay or of receiving capitalised value of pay.

Militia volunteers and pensioners to be officered from half-pay list.

Disapproves of promotion from ranks.—(Army Organization, p. 68.)

Lieutenant-Colonel **Baker**. Purchase above rank of Captain to be abolished. Field Officers to be selected by a military board.

Disapproves of promotion from the ranks.—(Army Reform, p. 52.)

Lieutenant-Colonel **Bannatyne** thinks it practically impossible to substitute for the purchase system a system of promotion that will work better.

Suggests that Militia should be officered from retired and full-pay lists.

That specially qualified men should be enlisted for appointment as Non-commissioned Officers, after one year's service in the ranks, with right to claim discharge at any time if deprived of their non-commissioned rank.—(Our Military Forces and Reserves, pp. 29, 40, 28.)

Lord **Elcho**. Volunteer Officers to be required to qualify for appointment and promotion, by a term of service with a line regiment.

Half-pay Officers unsuitable for command of Volunteers, local influence requisite as well as military knowledge.—(Letter to *Times*, 12th February, 1869.)

Lord **Monck**. Purchase system to be abolished.—(Debate reported in *Times*, 24th April, 1869.)

Lieutenant-Colonel **Leahy**. Purchase system to be abolished. Battalions to be commanded by Officers specially selected from a general list of Field Officers.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)

Colonel **Robertson**. Purchase of promotion to be abolished. A certain proportion of first commissions to be disposed of for a regulated price, not subject to condition of repayment on purchaser leaving the Service.

The remainder to be filled by competitive examination among candidates possessing certain qualifications defined by regulation.

Field Officers to be promoted by seniority from classified lists of Captains possessing one or more special qualifications defined by regulation. Changes of position to be permitted between Officers of the same rank, and Officers to be permitted to accept money as an inducement to retire or exchange.

The command of regiments of the line to be limited to a certain term of years.

The command of regiments of Militia to be given 1st, to Colonels of e Line who have completed their term of command of a Line batlion; 2nd, to Field Officers of the Line selected from the half-pay st.

Adjutants of the Militia and Volunteers to be selected from unarried Captains of the Line, a preference being given to old Adjunts, and the duration of the appointment being limited to three or ve years.—(Journal of the Royal United Service Institution, vol. xii, o. 49.)

Mr. Cardwell. Patronage of Militia regiments to be local, and urchase of Militia adjutancies to be prevented.—(Debate reported in *imes*, 11th June, 1869.)

B IV. Organization. *Suggestions relative to Territorial Distribution of Troops.*

Mr. Cardwell. Country to be divided into military districts, and all troops serving in the district to be under one chief, assisted by one set of executive and administrative Staff Officers.—(Debate reported in *Times*, 11th June, 1869.)

Sir C. Trevelyan. A separate complete military establishment, consisting of troops of the Line, Militia, and Volunteers, united by a regimental organization to be allotted to each county or military district.—(A Standing or a Popular Army, p. 14.)

Lord Elcho. Line regiments to be attached to particular localities.

Lieutenant-Colonel Leahy. Permanent Head-quarters to be assigned to each regiment.—(Journal of the Royal United Service Institution, vol. xii, No. 50.)*

Lord Monck. Each Line regiment to have a second battalion, having permanent head-quarters in a particular locality.—(Debate reported in *Times*, 24th April, 1869.)

C. Training. *Suggestions relative to Military Training, Individual and Collective.*

Mr. Cardwell. Training of soldiers transferred to Reserve, to be of the same character as that of Volunteers. Militia recruits to be trained by Officers of the Line. Yeomanry to be trained as mounted rifles.—(Debate reported, *Times*, 11th June, 1869.)

Sir C. Trevelyan. Soldiers' training to include school work as well as drill and gymnastic and military exercises.

Recruits for Line and Militia regiments to be trained together at the same depôt.

Officers of Militia and Volunteers to go through a prescribed course f instruction at head-quarters of Line regiments.—(A Standing or a opular Army, p. 14.)

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* See also papers by Captain Colomb, R.M.A., and Lieut.-Col. Malet, Gren. Gds., ol. xiii, pp. 37, 160.—Ed.

Sir A. ALISON. Each year all forces in one military district selected by lot, to be called out by telegraph to be assembled at a given point and distributed in garrisons and strategic positions.—(Army Organization, chap. ii.)

Lieutenant-Colonel BAKER suggests appointment of regimental Officer-instructors; one or more divisions to be assembled annually in the autumn under canvas, and manœuvred over an extensive tract of country (at least 30 miles by 20).—(Army Reform, p. 36.)

Lieutenant-Colonel BANNATYNE suggests that in towns it might be convenient to conduct the greater part of Militia training by companies in the vicinity of their homes on Saturday afternoons, in the same manner as the Volunteers are trained.—(Our Military Forces and Reserves, p. 22.)

Lord ELCHO. All the military forces of each district to be assembled for annual training under the General of the division. Supply and administrative services of the whole force to be performed by permanent Staff.

He also suggests simplification of drill, and that trades should be taught in addition to military exercises.—(Letter in *Times*, 12th and 16th February, 1869.)

Lord NORTHBROOK. Officers of Line regiments to be attached to Militia during annual course of instruction to assist in training.—(Debate reported in *Times*, 24th April, 1869.)

H. COLE, Esq., C.B. Compulsory drill to form part of the national system of education, to commence at ten years of age. Military pensioners to be attached to all schools as drill instructors.—(Report of Meeting of Society for Encouragement of Arts, Manufactures, and Commerce, 17th February, 1869.)

LECTURE.

Friday, June 18th, 1869.

Colonel T. ST. L. ALCOCK, Vice-President, in the Chair.

PRIMITIVE WARFARE—Section III. ON THE RESEMBLANCE OF THE WEAPONS OF EARLY RACES, THEIR VARIATIONS, CONTINUITY, AND DEVELOPMENT OF FORM—METAL PERIOD.

By Colonel A. H. Lane Fox.

Having in two previous lectures upon "Primitive Warfare," delivered at this Institution, spoken of the general principles to be observed in studying the development of the weapons of savages and early races, I need not preface the remarks I am about to offer by any detailed allusion to the generalizations which I have already ventured to make, but I will proceed at once to lay before you some additional facts which I have collected in continuation of the same subject.

This I do the more readily, because I hold strongly to the opinion that the value of a communication of this kind may, in a great degree, be measured by the attention which is paid to the accumulation of facts, and to the comparative brevity and simplicity of that portion of it which relates to theory. Without general principles, however, we should have no incentive to collect and systematize our facts, and they are therefore valuable even where they involve,—and in a new field of study, such as I am now treating, with very scanty materials as yet at our disposal to assist conjecture, I can hardly hope they should not involve,—a certain amount of error.

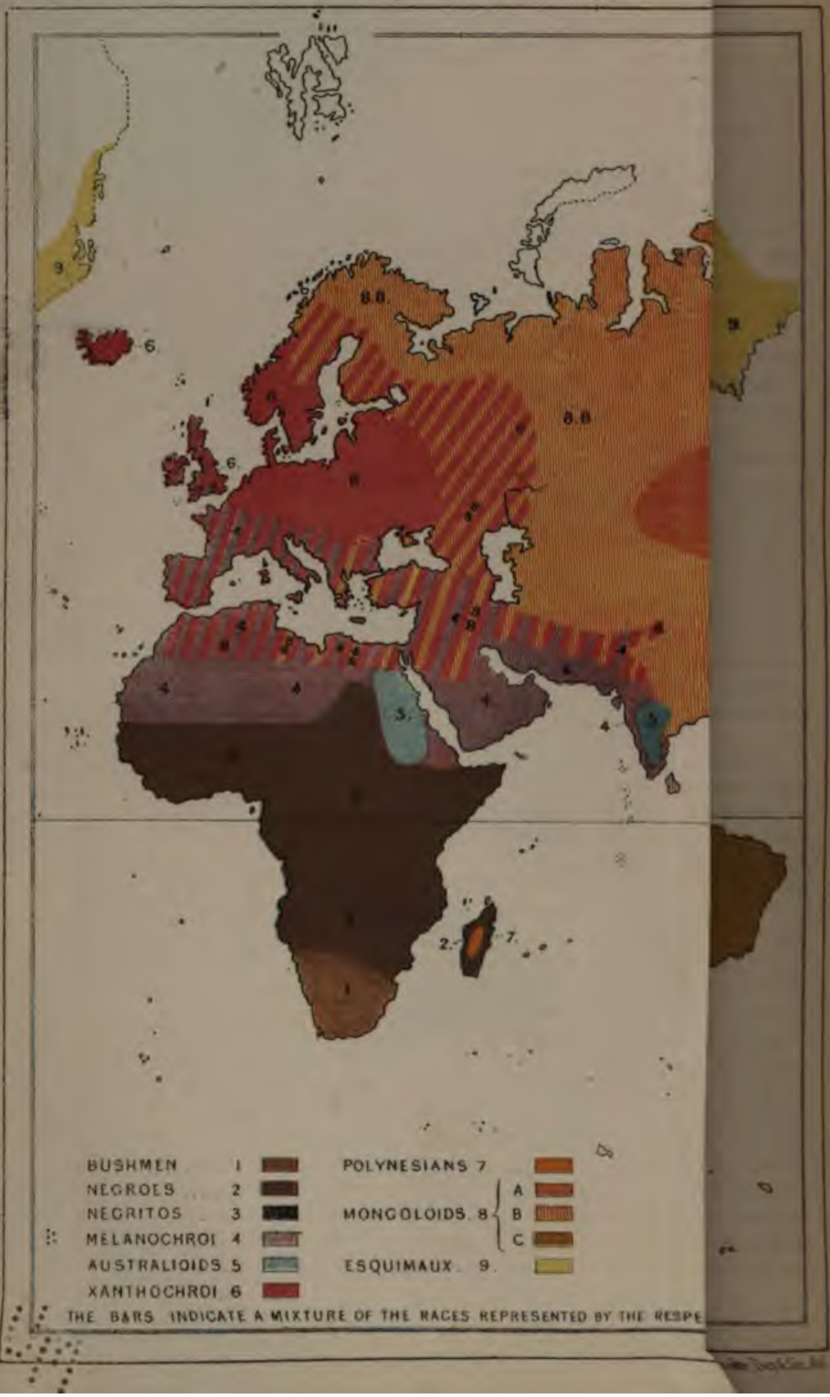
Before entering upon the subject of the origin of metal implements, I must, however, revert to one part of my former communication, in order to show that a statement I then made in reference to the geographical distribution of the boomerang has since had some light thrown upon it by the researches of one of our most eminent men of science. It will, perhaps, be remembered by those who did me the honour of reading my last lecture, which was printed in No. 51 of the Journal, that, in describing the weapons of the Australians, I showed, by means of numerous illustrations of the varieties of each class of weapon from that country, that they all passed one into the other by connecting links, so that where a sufficient number of them are arranged in such a manner as to exhibit their continuity, it is often impossible to determine any definite line of separation between them. I also showed that the form of each weapon was determined by the form of the stem or branch of the tree out of which it was made, the outline of all these implements conforming to the grain of the wood; and the inference which I drew from this was, that it showed a very low state of intellect on the part of the constructors, the several classes of implements not having been designed originally for their respective purposes, but produced accidentally, and then applied during subsequent ages to the several uses to which in practice they appeared most suited.

As we have no reason to suppose that the Australian continent was peopled at a later date than other parts of the world, and as there is no evidence upon that continent of the people inhabiting it having ever been in a higher state of civilization than they are at present, we have grounds for supposing that they must have remained stationary, or have progressed very slowly, while the inhabitants of other parts of the globe advanced more rapidly, and that their existing arts and implements, simple and primitive though they be, nevertheless represent the highest development of constructive power to which these people have ever attained. Hence it follows, that if the inhabitants of any other portions of the globe can be traced to a common origin with the Australians, viewing the persistency of type observable as a characteristic of the arts of these people, and of all other people in a primitive state of culture, we must expect to find some traces of similar implements in use amongst all such people, to whom a common origin can be assigned.

In my last lecture I mentioned that there were three countries in which the boomerang is either still used, or is known to have been used in ancient times, viz., Australia, the Deccan of India, and Egypt, and I also showed some grounds for believing that the same weapon, or something allied to it, may have spread from those countries over Europe, as it is known to have done over a great part of Northern and Central Africa.

Although the comparison of weapons from various parts of the globe can have no other object than to trace out an original connection, I did not venture to build upon the coincidence of this weapon in these regions, any argument for the common origin of the people by whom it was used. Nor do I think that I should have been justified in assuming such origin upon the grounds of the identity of a single weapon. Such identity may have arisen in three ways:—1stly. It may have arisen independently by the spontaneous development of like weapons under similar conditions of life; 2ndly. The weapon itself may have been communicated from some primal source; 3rdly. The races using it may have been themselves derived from a common origin. Of these, the first view, viz., the independent origin of the weapon, would perhaps strike any one at first sight, before having studied the conservatism and persistency of type which is so

MAP OF THE DISTRIBUTION



especially characteristic of savages, as the most probable; it appears so exceedingly simple in its form and uses to our trained and educated minds, that it seems hardly necessary to account for it in any other way; besides which, there are slight differences between the Indian and Australian boomerangs, which have been considered by some to distinguish the two weapons.

I will not here revert to the arguments which I have used to combat this opinion. Suffice to say, that I have since been favoured with much valuable information on the subject by Sir Walter Elliot, who has frequently accompanied the natives of India in their hunting expeditions with this weapon. He says that it is formed on the grain of the wood, like the Australian boomerang, the curve varying with the bend of the stem; it is whirled horizontally, with the end foremost, like the Australian practice, and is used by two tribes in the Deccan, viz., the Kolis of Guzerat, and the Marawárs of Madura, but more especially in its simplest form by the former, who are of the Dravidian, or black race of the Deccan. In a letter to me he says, speaking of these tribes:—"I have seen both, and, indeed, "served ten years in the latter district (Southern Mahratta), where "the crooked stick is used by all the lower orders every Sunday "during the hot season, when all agricultural labour is at a stand. "The villagers turn out in large numbers, and scour the jungle armed "with these sticks. Everything that rises is knocked over, deer, "hares, birds, even the wild hog and the tiger are occasionally (though "rarely, of course) included in the bag. I have seen a line of upwards "of 100 men and boys, and the boomerang whirling about in such "numbers, and with such precision, that even birds on the wing are "brought down. I never met with any regularly formed specimens, "except in the South; those in the North were mere angular sticks, of "very various form, as natural branches occurred; the favourite form "was a rather obtuse angle—nearly a right angle." Thus, whether we regard the purposes for which it is used, the material of which it is constructed, the manner of throwing, or the varieties of its form, he Indian and Australian boomerang is virtually the same weapon; and I think those who dispute their identity, appear rather to have had in view the "collery stick" of Madras and of the Marawárs than he boomerang of the Kolis.

We may, therefore, I think, fairly consider the causes which may have led to the adoption of this weapon as sprung from a common ource.

Since my last communication to this Institution, Professor Huxley has given to the world, in a paper read at the meeting of the International Congress of Prehistoric Archæology,—of which I had the honour to be General Secretary,—in August, 1868, his views "on the distribution of he races of mankind, as bearing on their antiquity." The paper created a considerable sensation in the scientific world, owing to the boldness of the generalizations contained in it, and, it may be added, a certain amount of opposition. The accompanying map (Plate XXXI) s taken from one drawn by Professor Huxley himself for the Ethnoogical Society, to illustrate this subject.

Basing his distribution of the human race on the principle that the characters of the hair and complexion are more permanent, and of greater value as a means of classification, than the bony structure of man, Professsr Huxley traces back the numerous varieties of tribes and races into what, for the present, may be regarded as four primary groups.

Commencing, for the convenience of my present subject, with the highest, or those which have shown themselves most capable of development, which, in all probability, is the wrong end of the scale to begin with, if we regarded them in their natural succession, the first of these groups is what he terms the Xanthochroid type (the distribution of which is marked red in the map), a people characterized by yellow hair and fair complexions, with blue eyes, who form a strong element in the composition of the population of this country and a great part of Europe, extending from thence through Scandinavia and Central Europe eastward into Northern India. Next to these he classes the great Mongoloid race (marked by various shades of yellow on the map), with yellow-brown complexions and black hair and eyes, of which the Kalmucs and Tartars represent the purest types, occupying the whole of Northern Europe and Asia, from Lapland to Behring Strait, and down to the southernmost parts of China, including also the Esquimaux, the Polynesians, and the whole of the inhabitants of the two continents of America. Thirdly, the negro race (marked black and brown in the map), long headed, with woolly hair, which has its head-quarters in all that part of Africa south of the Sahara, but has outlying branches widely detached, and occupying a broken line of islands extending in a belt from the Andaman Isles in the Bay of Bengal to the peninsula of Malacca, New Guinea, New Caledonia, and the adjoining isles, and having its southmost limits in the distant island of Tasmania. Lastly, we come to the Australioid race (marked dark blue), distinguished by dark chocolate complexions and black eyes, with long heads and soft wavy hair; these the Professor, upon physiological grounds, and after intimate acquaintance with these people in the distant regions in which they are found, traces in three distinct portions of the globe, viz., Australia, the Deccan of India, and Egypt; the three identical countries, it will be observed, in which, unconscious of Professor Huxley's distribution of races, I had traced the occurrence of the boomerang. I think, therefore, it is not an unreasonable conjecture, assuming the correctness of Professor Huxley's premises, that this peculiar weapon may be a relic of the original Australioid stock, which having been originally an effective weapon for all purposes amongst the aborigines of this race, and continuing still to be used as such in Australia, survived in India and in ancient Egypt merely as an implement for the chase and for amusement, much in the same way that in Europe, bows and arrows have survived amongst children to the present day.

In the remarks which I made upon the varieties of the African boomerang, I drew attention to the peculiarly curved form of the Nubian and Abyssinian sword, and I ventured an opinion that its form may have been originally derived from that of the boomerang, of which weapon a variety, constructed of wood, is still in use by the inhabitants of the country; and I see no reason to doubt that the Abyssinian sword may have been the prototype of those numerous allied forms of iron weapons, the "Hunga Munga," &c., which throughout Africa are still used as missiles, and thrown with a rotatory motion like the boomerang. My conjecture on this subject appears to receive some confirmation from the very peculiar construction of one of these swords, which has lately been added to the museum of this Institution, and which is represented in fig. 1, Plate XXXIII. The angular form of the blade, swelling in the middle, presents such a close affinity to the Australian boomerang, as to strike even those who have not been led by the considerations I have mentioned, to look for a coincidence in these weapons. I noticed at the same time the very great resemblance between the rudimentary shields of the Australians and those of some of the inhabitants of the valley of the Upper Nile, which may also perhaps be accounted for in the same way. With a view of further connecting this primitive form of shield with similar defensive weapons in India, it is worthy of notice, that the hand-shield, having antelopes' horns projecting from it, a representation of which was given in my first lecture, Plate LII, figs. 66, 67*a*, and 69 (many of which are furnished with a small iron shield, or guard for the hand, though some are without this accessory), Sir Walter Elliot now informs me is used precisely in the same way as the Australian and African parrying-shields, viz., by catching the arrows and darts of the assailant, and parrying them off with the horns, thus favouring the conjecture that I ventured to put forward, that the square, oblong, and circular targets are defensive weapons of comparatively recent origin, being represented in a primitive stage of culture by a simple parrying-stick, derived originally from the club. The club is, as a general rule, the only defensive guard employed by races in the lowest stages of culture. These seem to have been replaced by parrying-sticks, held in the centre, and subsequently hollowed to receive the hand, or furnished with hand-guards, forming rudimentary shields; of which stage in the development of the weapon we are now able to establish connected traces in the three countries under consideration.

If the comparisons which I have made, and the conclusions I have ventured to draw from them, are found to stand the test of further investigation, as it appears to me reasonable to hope they will, the importance of studying the forms and uses of these primitive weapons in connection with other sociological and biological phenomena, as a means of tracing back the early history of mankind, will be well established. Of this, however, we may feel certain, that if a connection formerly existed between the inhabitants of India, Australia, and Egypt, the evidence of such connection will not be limited either to the colour of the hair and skin, or to the resemblance of their weapons, but will be found in other customs and institutions which they brought with them from their fatherland. The important generalizations of Professor Huxley, whether or not they ultimately hold good, have had the good effect of drawing attention to a comparison of the inhabitants of these countries; and though it would be foreign to my present purpose to anticipate the result of these investigations in other branches not immediately connected with my present subject, I may mention that Officers acquainted with India and Australia have since pointed out resemblances in the hymeneal and other customs of those countries, which have not before been noticed, but which, when put together and compared, making all due allowance for the variations which are inevitable in the continuous development of all human arts and institutions, will, I doubt not, tend to give confirmation to the theory of races which the author of it has so ably advanced.

Having strayed thus far into the geological and biological aspect of the question, it is necessary to go a step further in order to apply the subject more generally to the origin of weapons, and at the same time to point out some difficulties which stand in the way of accepting this theory of races—difficulties of which Professor Huxley himself appears by his paper to be fully sensible.

The detached portions of the Australioid race are separated from each other by seas of considerable depth, and the same thing applies to the Negroid race. The Australians, he points out, though possessing ample materials for the construction of canoes, have never learnt to make any that are capable of traversing the great seas which separate them from their apparent kindred in other lands, and it is unlikely they should have forgotten the art of navigation if they had once known it. It is inconceivable, therefore, that they should have migrated from Australia to the Deccan, and to Egypt, during the existing geographical arrangement of sea and land, more especially as no trace of such migration is found upon intervening isles. He points out, however, that great geographical changes have probably taken place, and that those changes, in so far as our knowledge of them goes, are of a nature to account for the phenomena observed.

The region of the negro race in Africa is separated from Northern Africa and from Europe by the desert of Sahara, of which there is geological evidence to show that it was sea at a recent geological period. The same applies to the Deccan of India, which is separated from the Himilaya by the great alluvial plains of the Indus and the Ganges, which, having probably formed a strait before the miocene epoch, may have divided the black men inhabiting the Deccan from the Xanthocroid and Mongoloid races to the north. At the same time large tracts now occupied by the sea may then have been land, uniting or connecting by a chain of easily accessible islands, the regions in which men of the same colour and physical peculiarities are now found. But it will be seen by the map that the lines of distribution of two of the races, the Negroid and the Australioid, cross each other, and this, according to the theory of migration by land, appears to involve a succession of submersions and upheavals during the human period, which it is difficult to account for.

The distribution of races, according to supposed original distinctions of colour and complexion, will be seized upon by polygenists as an argument in their favour; for it will be said, according to this theory, that the distinctions of race in the earliest times must have been as great, or greater, than they are at present.

There are three ways in which it has been attempted to account for these early distinctions of colour and persistency of type—1stly. By supposing the several races of man to have been separately created upon distinct continents of land. 2ndly. By assuming that on each primeval continent, man was evolved from the anthropoid apes of that continent.* Or, 3rdly, by supposing that these divisions of race, remotely and immeasureably distant though they be, nevertheless, carry us only a short way back into the history of man, and that still earlier ages, if we could penetrate them, would show the races of man united.

Now, with respect to the first assumption, that of creation, though we are not, of course, in a position to deny the possibility of it, I confess it appears to me unwarranted by any of the phenomena of nature. We have no knowledge of the special creation of any organized being; and how can we scientifically assume as probable, that, for the probability of which there is no sort of evidence of a nature that inductive science would be warranted in building upon. Continuity and development are seen to be the order of the universe. Man is seen to be, both mentally and physically, amenable to that law; and on what grounds can we assume that he was ever an exception to it? I cannot conceive how those who believe geological changes to have been brought about by causes which are still in operation in our own day, and who make great calls upon time in order to reconcile those causes to the phenomena observed, can, in treating biological phenomena, advocate belief in so great a break in the observed order of the universe as is implied by the special creation of man. Still less willing am I, in the absence of more cogent argument than has ever yet been advanced in support of it, to assent to hypotheses of the separate development of races, which appears to me equally at variance with nature. There can be no doubt that all the existing races of man, whatever their colour and physical peculiarities, have greater affinity to each other than any of them have to the apes, or to any other class of animals. The tendency of progress is from simplicity to complexity, from unity to diversity, and it would be a complete inversion of the order of nature that animals so various as the apes, should independently produce animals so much resembling each other as the races of man. The recognized law that, with certain variations, like begets like, appears to me to negative this assumption as fully as it would do the notion, if it were put forward, that because the horse and some other classes of the mammalia, say the rhinoceros, for instance, have some affinities in their bony structure, therefore the black horse is descended from the African rhinoceros, and the white horse from that of India. Moreover all the races of mankind inter-breed, and I am at a loss to understand how a circumstance like this, which throughout the animal kingdom is regarded as a proof of unity of species, should be discarded in its application to humanity. If, then, it is true that diversity of colour is as old as the very earliest traces of man, and there is evidence that the several coloured races were inhabitants of distinct continents, which have disappeared through geological changes dispersing and mixing the races, blending the colours and obliterating the traces of their formerly isolated homes, then to the same causes which produced the mixing and the blending, we must also attribute the original separation. According to the view I hold, we must ask for more time and still further geological changes to bring them together again in the primeval cradle of the human race.

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* "Lectures on Man, his place in Creation, and in the History of the Earth," by Dr. Carl Vogt. Edited by James Hunt, Ph.D.

Now, to apply this reasoning to the origin of weapons. The only vestiges of the primeval tools of mankind now left to us, are those constructed of stone; others of the more perishable materials have decayed, and their representatives only have remained in some few cases as survivals. In my last lecture I showed how uniform in shape and in development these stone implements are found to be in all parts of the world, whether derived from the northern or southern continents of America, from Siberia, Australia, India, Africa, or the surface soils and river gravels of Europe. This uniformity of shape has been used as an argument that mankind must have independently designed the same forms of tools in various parts of the world, and that under like conditions, like forms will be produced by men, however remotely separated. I am not prepared to deny the possibility of some of these forms having had an independent origin; but if the proof of it is to be based upon the separation of continents, we see how entirely groundless such an argument is when applied to the earliest ages of humanity. For if, as has been conjectured, the races of man may have been dispersed by geographical changes of land and sea, it is obvious they may have carried with them, from some primal source, the art of manufacturing stone weapons, the resemblance of which is far more satisfactorily accounted for by this means* than by supposing such singular and invariable coincidence in design to be the result of independent discovery. As we contemplate man in his lower and lowest conditions, we find the imitative faculty stands out more and more prominently by the absence of those higher qualities which characterize civilized races; and whatever power of originality for the invention of new arts may have been possessed by the earliest inhabitants of the globe, its results appear to have been spread over so vast a lapse of time that it can scarcely be accounted at all as an element in the mental attributes of primeval man.

I now pass to what has been announced as the subject proper of my present communication, viz., the origin and development of metal tools. I use the word *metal* intentionally, in preference to specifying bronze, because, although we have good reason for supposing that in Europe, Egypt, Assyria, and the central parts of

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* The fact mentioned both by the Baron de Bonstetten and Dr. Keller, of celts of jade and nephrite having been found in Switzerland, materials which, according to the latest investigations, are not found in the Alps, but must have been imported from the East, proves that intercommunication and barter must have been carried on between distant countries at the time when such weapons were used.—"Recueil d'Antiquités Swisses," par M. le Baron de Bonstetten; "The Lake Dwellings of Switzerland," by Dr. Keller, pp. 56, 68.

America, bronze preceded iron as a material for weapons, it is not so certain that this was the case in all parts of Asia; and in Africa, we know that iron was the first metal employed by the negroes.

Perhaps no subject has given rise to so much difference of opinion amongst archæologists as this question of the origin of metal implements, or has been accompanied with such uncertain results, owing to the great mass of conflicting evidence to be dealt with, and the great doubt which rests upon much of it, whether in regard to the casual mention of the subject in ancient authors, or to the often ill-directed researches of modern times. It would be hopeless in the brief time allotted me on the present occasion, to attempt to throw fresh light on this intricate subject, even if I possessed the materials for so doing. All I shall endeavour to do is, to put together, in as intelligible a form as possible, some of the more salient points upon which archæologists are divided, and trace the continuity observable in passing from the stone to the metal age.

We have already seen, in speaking of the implements of the stone age, a gradual improvement in form and fabrication, developing itself in proportion as the wild animals which were contemporaneous with the first traces of man in Europe, became extinct, partly, no doubt, through the efforts of man himself in exterminating them, and partly, as there seems reason to suppose, owing to an alteration of temperature, rendering the climate unsuited to the constitution and habits of those animals, which therefore migrated by degrees, and the majority of which are now found chiefly, though not exclusively, in arctic regions. Thither they have been accompanied by races of men whose arts and implements show them to be very nearly in a corresponding stage of civilization to the early races, the relics of which are found associated with the same animals in Europe. The simultaneous migration of races of men in the hunting stage of civilization, with the animals, the pursuit of which forms the almost sole occupation of their lives, is well shown in the case of the North American Indians, whose geographical distribution is now almost identical with that of the buffalo. This forms a strong point in the arguments of those who are disposed to attribute all the changes in the world's civilization to the influx and extermination of antagonistic races. But it must be remembered that progress advances in an increasing ratio, and the phenomenon now seen in America and Australia of a highly civilized race constantly fed by steam-communication from the Old World, driving before it and rapidly exterminating other races so vastly its inferior as the Australians and American Indians, is one which could have had no parallel at the early period of which I am now speaking. We must here look for a slower process, though doubtless the operating causes may, to a great extent, have been the same.

The fabrication of stone implements would of itself lead by degrees to a knowledge of the metals which are contained in stones. Thus, for example, I have here a specimen of a stone mace-head from Central America, fig. 2, Plate XXXIII, composed of a nodule of hæmatite partially coated with micaceous iron ore, the particles of which are distinctly visible on its glittering surface. The weight of this implement being nearly double that of a mace-head composed of ordinary stone, would at once attract the notice of the savage fabricator, and lead him to investigate the uses of metal.

But, as a general rule, races engaged exclusively in hunting, who rarely turn their attention to the ground except to examine a trail or to search for water, would have little opportunity of profiting by the mineral wealth of the soil over which they roamed. Witness the Australians, who have continued for ages in ignorance of the gold and other mines which are now so attractive to Europeans; or the North and South American Indians, and the Esquimaux, amongst whom the art of smelting metal has never been found associated with those races who are in a purely hunting stage of existence; the wrought metals used by such races to point their weapons being invariably derived from civilized sources.

From hunting wild animals, the savage, in the natural sequence of progress, would turn his attention to their capture and domestication, and thus he creeps gradually into the pastoral life, and as the bones of animals under domestication, through want of exercise and good living, become smoother and of finer texture, the experienced anatomist is thereby afforded the means of distinguishing amongst the vestiges of antiquity, the remains of domesticated animals from those derived from the chase, and of observing to what extent the domestication of animals was contemporaneous with other changes in the social condition of the people.* Still, however, in the pastoral state, the barbarian is not necessarily brought in contact with metals; and hence we should expect in many cases to find the traces of domesticated animals associated with people who are still in the stone age. This was notably the case amongst the ancient inhabitants of the Swiss lakes, where the sheep and horse have been found at Moosseedorf, and other lake habitations, which are proved to belong to the stone age, though not in such abundance as in those settlements belonging to the bronze age.†

From the pastoral life, the barbarian, hampered by his flocks and herds, and no longer obliged to wander in search of food, settles down to a more stationary life, and by degrees takes to agriculture. Then, for the first time, he digs into the soil, and becomes acquainted with its mineral treasures. It has been proved by the discovery of quantities of carbonised grains of wheat, lumped together, in the Swiss lake habitations of the stone age, together with the materials for preparing it for food, that a knowledge of agriculture preceded the general employment of bronze in that region,‡ whilst in Britain, and in Denmark also, bronze is almost invariably associated with evidence of domestication and agriculture.

The metals first employed would be those that are most attractive. Copper, in Europe, from the bright colour of its ores, would be noticed more readily than iron, which is often scarcely distinguishable from the soil, and requires greater temperature and more skilled labour to render it available than could be expected of a people emerging out of the savage state. It is not, therefore, surprising that in Europe, copper first, and subsequently its alloy, bronze, should have been employed before iron as a material for weapons. But in those countries where iron is found upon the surface in an attractive form, and in a condition to be easily wrought, we must for the same reason suppose that it would be used instead of copper in the earliest ages of metallurgy.

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* "Prehistoric Times," by Sir John Lubbock, Bart., F.R.S., p. 147.

† "Prehistoric Times," by Sir John Lubbock, Bart., F.R.S., pp. 142-143. "Results of the Investigation of Animal Remains from the Lake Dwellings," by Prof. Rütimeyer. "The Lake Dwellings of Switzerland," by Dr. Ferdinand Keller, translated by J. E. Lee, F.S.A., F.G.S., pp. 355-362.

‡ "Moosseedorf," Keller, p. 35. "Robenhausen," Keller, p. 40.

But implements of pure copper are comparatively rare, bronze being the metal almost invariably found following immediately upon the age of stone, and it is natural to suppose that in the ordinary course of development, an age of pure copper must have intervened between the ages of stone and bronze. Notwithstanding the comparative rarity of copper tools, however, there is reason to believe that this metal was used in a pure state before the discovery of the alloy. According to Professor Max Müller, copper was the metal spoken of by Hesiod and Homer as the material generally employed for weapons in their time.[*] Mr. Rawlinson, in his "Five Ancient Monarchies," says that the metallurgy of the early Chaldeans was of a very rude character, indicating a nation but just emerging from an almost barbaric simplicity, and that copper often occurs pure.[†] Copper implements, of a very early form, beaten into shape, occur not unfrequently in Ireland, as may be seen by specimens represented in Class A, Plate XXXII. They have also been found in Mecklenburg and in Denmark, and Klemm[‡] says that they occur in Greece, Italy, Spain, Egypt, and Hindustan. At Maurach, in Switzerland, a copper celt was found in a lake dwelling, which Dr. Keller, notwithstanding this circumstance, attributes to the stone age.[§] In the lake dwelling of Pescheira, on the lake of Garda, several copper implements were discovered,[||] and in certain localities in Hungary, copper implements are said to be as plentiful as those of bronze.[¶] An axe of pure copper was discovered in Ratho Bog, near Edinburgh, under 20 feet of stratified sand and clay, and Dr. Wilson mentions that others have been found in Scotland.[**] Copper implements occur in Peru, to prove that in the central parts of America also, the manufacture of bronze was preceded by the use of copper in a pure state; and in the ancient mines of Lake Superior we have distinct evidence of a stage of early metallurgy in which copper was used simply as a malleable stone, and beaten out into the form of implements without the aid of any alloy or a knowledge of the process of casting.[††] (See figs. 3, 4, 5, and 6, Plate XXXIII.)

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[*] "Science of Language," second series, p. 230.

[†] "The Five Great Monarchies of the Ancient Eastern World," by George Rawlinson, M.A., vol. i, p. 123.

[‡] "Werkzeuge und Waffen," by Dr. Gustav. Klemm, p. 96.

[§] Keller, p. 116.

[||] Keller, p. 221, Pl. lxvii.

[¶] Keller, p. 218, 219, Pl. lxviii.

[**] "Prehistoric Man," by Daniel Wilson, LL.D., vol. i, p. 282.

[††] "Prehistoric Man," vol. i, pp. 231—279. "Smithsonian Contributions to Knowledge," vol. i, pp. 196—203, from which works the illustrations are taken.

When it is considered that without the admixture of a small portion of alloy of zinc or tin, copper is very difficult to melt, and can only be used by a laborious process of beating into form, and also what a great superiority bronze has over copper as a cutting material, whilst at the same time the process of fabrication is actually in some degree facilitated by the addition of tin, it is not surprising that on the first discovery of the advantages of this mixture, all the old implements of copper, wherever procurable, should have been taken to the melting-pot for conversion into bronze, and we should thus be left with such scanty evidence of the existence of an age of copper.

Up to this point we meet with no difficulty in supposing that the use of metal may have been at first adopted by many nations independently, without intercourse one with another. But when we find in both hemispheres of the globe a very wide diffusion of weapons of bronze, consisting of a mixture of the same metals, which, though varying slightly in its proportions, as we shall afterwards see, is nevertheless, for the most part, constant in its adherence to a standard of about nine parts copper to one of tin in all parts of the world, the question arises whether the knowledge of this mixed metal could have been arrived at independently in different countries, or whether it must have been diffused all over the universe from a common source. It is true that copper and tin minerals are sometimes found in the same locality, as, for instance, in Cornwall, the locality which, from the remotest time up to the present, has afforded the most plentiful supply of both metals perhaps in the world. We have evidence, also, that in ancient copper mines, fire was employed by the miners for softening the metal and detaching it from the matrix,* and it is, therefore, highly probable that the admixture of the two metals occurring so close together, and a knowledge of the advantages accruing therefrom, may have been brought about accidentally in the process of mining.† But this connection of the metals in a state of nature is not common, and in those countries, such as Denmark and Scandinavia, where bronze implements occur, and in which neither metal is found native, it is most improbable that the inhabitants should have discovered the merits of these particular ingredients, unless they had derived the knowledge of it from without.

Hence we find archæologists as much divided in their opinions upon what I may call the monogenesis or polygenesis of bronze as biologists and anatomists are upon the monogenesis or polygenesis of the human race. The same question repeats itself again and again in dealing with the vestiges of the early history of man, and we may therefore divide the consideration of this question of the origin of bronze under pretty nearly the same heads to which I have adverted when speaking of the distribution of races, and of the age of stone. The questions to be considered may be numbered as follows:—1stly. That bronze was spread from a common centre by an intruding and conquering race, or by the migration of tribes; 2ndly. That the inhabitants of each separate region in which bronze is known to have been used, discovered the art independently, and made their implements of it; 3rdly. That the art was discovered, and the implements fabricated, on one spot, and the implements disseminated from that place by means of commerce; 4thly. That the art of making bronze was diffused from a common centre, but that the implements were constructed in the countries in which they are found.

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* "Prehistoric Man," vol. i, 253.

† Since writing the above, Sir John Lubbock has published in an Appendix to his second edition of "Prehistoric Times," letters from Dr. Percy, and from Messrs. Jenkin and Lefeaux, highly experienced assayers, expressing their opinions upon the theory of M. Wibel, that the ancient bronze was obtained, not by the fusion of copper and tin, but directly from ore containing the two metals. They are unanimously of opinion that this could not have been the case, none of the ores containing naturally a mixture of the metals in proper proportions. Although the opinions of these gentlemen appear decisively to negative the possibility of ancient bronze having been habitually produced for commercial purposes in this manner, they do not appear to me to discredit the supposition that the first imperfect knowledge of the mixture may have been brought about accidentally in the manner I have described.—A. L. F.

Amongst the advocates for the first hypothesis, viz., introduction by the intrusion of fresh races, are to be found chiefly the Scandinavian archæologists, amongst whom may be especially mentioned Professors Worsaae, of Copenhagen,* and Nilsson, of Stockholm. Both metals are foreign to the soil of Denmark, and must, therefore, have been imported. In the graves, bronze weapons are in Denmark invariably found with burials by cremation, while those of the stone age are by inhumation, the former being recognised in an early stage of civilization as a later process than burial by inhumation. Bronze is here markedly associated with traces of agriculture, the evidence of which is wanting in the stone age. The age of bronze, it is asserted by these antiquaries, was ushered in in Denmark by the employment of implements showing the highest perfection of art, and at a later period, when they are associated with weapons of iron, they are inferior in the quality of their workmanship. The weapons of bronze have remarkably small handles, denoting a smaller race, and hypothetically an eastern origin, small handles being to this day the characteristic of weapons from India. Some of the bronze spear-heads in Denmark have been found with nails driven into them, a practice which still exists in India, each nail denoting a victim; and in the Asiatic Islands the custom of boring a hole in the weapon for each victim is found to the present time.† The peculiar ornamentation so often found on the bronze swords of Denmark, known as the spiral ornament, is said, though I think erroneously, to be of Phœnecian origin. To these and other arguments for the introduction by intruding races, Professor Nilsson adds, that in the countries of the north, where bronze implements are found in greatest abundance, the graves in which they occur are usually situated in groups, proving that bronze was introduced, not by isolated individuals, merchants, or travellers, but by tribes or colonies more or less numerous, occupying especial tracts of country.

The theory of race-origin is also not without its adherents in this country. Dr. Thurnam, who has excavated a large number of barrows in the south of England, divides them—as, indeed, they have been divided by former antiquaries—into several classes, amongst which we may chiefly distinguish two principal types, viz., the long and the round barrows. The former he attributes to the stone age, containing usually implements of that material, whilst implements of bronze are almost invariably found in the round barrows. He also gives it as the result of his researches, extending over some years of exploration—and Canon Greenwell, in so far as his experience of long barrows in the north of England goes, confirms the statement—that, the long barrows are generally associated with dolichocephalic, or long skulls, whilst in the round barrows brachycephalic, or round skulls, are found, thus leading to the supposition that the long-headed people of the stone age who erected the long barrows may have been succeeded by another race with round heads importing bronze, and burying their dead in round barrows. But after having heard Dr. Thurnam's last papers on this subject, read before the Society of Antiquaries and other societies,* I confess, although he has no doubt established a sequence, that he does not appear to me to have determined a clear line of separation between the two classes of interments; the long barrows pass by intermediate links into the round ones, and the long skull, although no doubt it may be considered characteristic of an earlier period, and therefore connected with an earlier form of barrow, also passes by gradations into the round skull, the variations of form being considerable. Then with respect to the implements; although the absence of bronze in the long barrows of the earlier period appears to be determined, yet it is notorious to all those who have paid attention to the subject—and is not by any means denied by the learned antiquaries whose names I have mentioned—that the transition from stone to bronze in this country was gradual, and extended over a long period, flint weapons being found in nearly all the barrows of the bronze age in such positions as to show they were used contemporaneously by the same people; and from discoveries which have been made both by myself and others,† there seems good reason to suppose that flint weapons continued to be used by some of the inhabitants of this country even during the Roman era. This distinction of long heads in long barrows, and round heads in round barrows, is one so easily remembered, that it is liable on this account, perhaps, to receive greater attention than it really deserves as a criterion of race. The difficulty of distinguishing in all cases the primary from the secondary interments in the barrows—it being an established fact that these barrows were used as places of burial by successive generations, and even perhaps by successive races, including also the Anglo-Saxons—the possible distortion of some of the crania by time and pressure, and the other facts of the case, as I believe I have correctly stated them, are, I think, sufficient to justify us in withholding for the present our entire acceptance of the theory of the introduction of bronze into this country by intruding races, as drawn from any evidence derived from the graves.

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* "The Primeval Antiquities of Denmark," by J. J. A. Worsaae, pp. 24, 40—45.

† The custom of making a mark upon the weapon for each victim slain, is one of very usual occurrence among savage people.

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* "Ancient British Barrows," by John Thurnam, Esq., M.D., F.S.A., "Archæologia," vol. xlii. "Crania Britannica," by J. B. Davis, M.D., F.S.A., and John Thurnam, M.D., F.S.A.

† "On some Flint Implements found associated with Roman Remains in Oxfordshire and the Isle of Thanet," by Col. A. Lane Fox, "Quarterly Journal of the Ethnological Society," April, 1869.

From amongst those who have advocated the totally independent origin of bronze, the opinion of Professor Daniel Wilson may be selected, as affording a most ingenious argument derived from an analyses of the metals.* He quotes some experiments conducted by Dr. George Pearson, and communicated by him to the Royal Society of London of 1796, to ascertain the results of various proportions of the ingredients of tin and copper in bronze. "Having fused these " metals in various united proportions, commencing with 1 part of tin " to 20 parts of copper, which produced a dark-coloured bronze, he " reduced the proportion gradually to 15 parts of copper to 1 of tin, " when the colour was materially affected, and the red copper hue " was no longer seen, but an alloy of greater strength was produced. " The experiments were continued with 12, 10, 9, 8, and 7 parts of " copper to 1 of tin, and when the last fusion of the metals was tested, " increased hardness and brittleness of the metals became very apparent. The same characteristics were still more marked on successively reducing the proportions of copper to 6, 5, 4, and 3; and " when an alloy was made of 2 parts of copper to 1 of tin, it was, " according to Dr. Pearson's report, as brittle as glass."

From the result of these experiments we see that the best average proportions of about 9 parts of copper to 1 of tin, would invariably show itself by a practical experience in the use of these ingredients, and it is therefore unnecessary to assume that these particular proportions, when found in the bronzes of different countries, must necessarily have been communicated.

Dr. Wilson then proceeds to give the results of analyses of ancient bronzes discovered in Europe, America, and elsewhere, contained in the accompanying tables. And he concludes his observations on the subject as follows:—

"From the varied results which so many independent analyses dis" close, varying, as they do, from 79 to 94 per cent. of copper, or more " than the total amount of the supposed constant ratio of tin, besides " the variations in the nature, as well as the quantity of their ingre" dients" (a proportion of lead will be seen in some of the analyses of European bronzes, the small proportion of iron being probably accidental), "it is abundantly obvious that no greater uniformity is " traceable than such as might be expected to result from the " experience of isolated and independent metallurgists, very partially " acquainted with the chemical properties of the standard alloy, and " guided for the most part by practical experience derived from suc" cessive results of their manufacture." The comparison of the two tables here given from Professor Wilson's work also shows a smaller average amount of tin in the American bronze than in that of ancient Europe.

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* "Prehistoric Man," by Daniel Wilson, LL.D., vol. i, p. 308.

Analyses of Ancient European Bronzes.

			Copper.	Tin.	Lead.	Iron.
1 Lituus	Lincolnshire	Dr. G. Pearson, F.R.S., Phil. Trans.	88·	12·		
2 Anglo-Roman-Patellæ	.. ..	Ditto ditto	86·	14·		
3 Spear-Head	.. ..	Ditto ditto	86·	14·		
4 Scabbard	Danish?	Ditto ditto	90·	10·		
5 Axe-Head	Ireland	Ditto ditto	91·	9·		
6 Axe-Palstave	Cumberland	Ditto ditto	91·	9·		
7 Axe-Head	.. ..	Ditto ditto	88·	12·		
8 Bronze-Vessel	Cambridgeshire	Professor Clark, M.D.	88·	12·		
9 Sword	France	Mongez M. de l'Institut	87·47	12·53		
10 Caldron	Berwickshire	G. Wilson, M.D., Prehist. Ann. Scot.	92·89	5·15	1·78	
11 Sword	Duddingstone	Ditto ditto	88·51	9·30	2·30	
12 Kettle	Berwickshire	Ditto ditto	88·22	5·63	5·88	
13 Axe-Head	Mid-Lothian	Ditto ditto	88·5	11·12	0·78	
14 Caldron	Duddingstone	Ditto ditto	84·8	7·19	8·53	
15 Palstave	Fifeshire	Ditto ditto	81·19	18·31	0·75	
16 Sword	Ireland	Professor Davy, Prehist. Ann. Scot.	88·63	8·54	2·83	
17 Sword	.. ..	Ditto ditto	83·50	5·15	8·35	3·
18 Sword	Thames	J. A. Phillips, F.G.S, &c.	89·69	9·58	..	0·33
19 Sword	Ireland	Ditto	85·62	10·02	..	0·44
20 Celt	.. ..	Ditto	90·68	7·43	1·28	
21 Axe-Head	.. ..	.. ..	90·18	9·81		
22 Axe-Head	.. ..	Ditto	89·33	9·19	..	0·33
23 Celt	.. ..	Ditto	83·61	10·79	8·20	0·58
24 Celt	King's County, Ireland	Dr. Donovan, Chem. Gazette	85·23	13·11	1·14	
25 Drinking-Horn	.. ..	.. ..	79·34	10·87	9·11	
26 Bronze-Vessel	Ireland	Gibbon, U. S. Mint	88·	12·		
27 Wedge	.. ..	Ditto	94·	5·9	..	0·1

ANALYSES OF ANCIENT AMERICAN BRONZES.

			Copper.	Tin.	Iron.
1 Chisel from Silver Mines	Cuzco....	Humboldt......	94·	6·	
2 Chisel " "	Cuzco....	Dr. J. H. Gibbon	92·385	7·615	
3 Knife " Grave......	Atacama..	J. H. Blake, Esq.	97·87	2·13	
4 Knife................	..	Ditto	96·	4·	
5 Crow-Bar............	Chili	Dr. T. C. Jackson	92·385	7·615	
6 Knife................	Amaro...	Dr. H. Croft....	95·664	3·965	0·371
7 Perforated-Axe.........	..	Ditto	96·	4·	
8 Personal Ornament.....	Truigilla.	T. Ewbank, Esq.	95·440	4·560	
9 Bodkin from Female Grave................	..	Ditto	96·70	3·30	

This argument, however, is defective when taken to determine the question of the origin of bronze in favour of independent discovery, for as we have already seen, in speaking of the stone age,—and I have endeavoured to show that it is a peculiarity observable in the works of all savage and barbarous races,—that being devoid of rule or measure, and having very imperfect means of securing adherence to a uniform standard, their productions are characterized by incessant variations, even in cases where the first idea is known to have been derived from a common source. The variations here shown to exist in the composition of bronze are no greater than are capable of being accounted for by the universal prevalence of a law of variation, resulting from many causes, and amongst others from want of precision, and carelessness, which is a defect common alike to all tyros in their art, whether ancient or modern. It is a fault we have many of us to complain of almost daily in our cooks. A batter pudding is composed of milk, flour, and eggs, in proper proportions, but a careless cook will constantly vary her proportions, and will fail in adjusting her quantities to the total amount; but we must not, on that account, assume that each cook has invented the art of making batter puddings independently. So, in like manner, it is quite consistent with the facts observed even in America, to suppose that the first knowledge of bronze, and of those many features in the civilization of the Mexicans and Peruvians, which present such striking analogies to the civilization of Egypt, may have been originally communicated by some casual wanderer or some shipwrecked cast-away from the then centres of Eastern culture (for the theory of geographical changes is, of course, out of the question when speaking of the origin of bronze), and that they have varied in their development on American soil no more than might naturally be expected from their introduction to an entirely new and partially civilized race. Such an assumption, though difficult to account for, and wanting in evidence, is more in accordance with the well-known traditions of the Mexicans and Peruvians, who attribute their civilization to the advent of a god; or with that of the natives of Nootka Sound, on the north-west, who state that an old man entered the bay, in a copper canoe, with paddles of copper, and that the Nootkans by that means acquired a knowledge of that metal.

As illustrations of the modern metal work of the natives of Nootka Sound and its neighbourhood, several examples are given in Plate XXXIII, figs. 7 to 11. Figs. 7 and 8 represent two sides of an iron dagger in the Museum of the Royal United Service Institution. The ornamentation on the handle is that of the natives of the country, but the workmanship of the blade, which is ribbed on one side, appears to indicate foreign manufacture. Figs. 9 and 10 are two sides of a copper dagger of the same form; this specimen is now in the Belfast Museum, in which it was deposited in the year 1843, by Mr. A. Thompson, who brought it from the north-west coast of America, and described it as having been fabricated by the Flathead Indians; it is undoubtedly of native workmanship; in both these weapons one side of the blade and handle is concave, the other convex, a form which appears to denote that it was originally taken from some similar weapon of bone or cane. The nearest approach to the form of this weapon in bone, that I am aware of, is that of the Indian kandjar, a figure of which was given in my first lecture on Primitive Warfare, Plate LII, fig. 63. This weapon has also one concave and one convex side, derived from the natural curvature of the bone out of which it is made.

But putting aside American civilization, which, it must be admitted, does in the existing state of our knowledge present great difficulties in the way of those who advocate the theory of a common origin for bronze, and turning our attention to the eastern hemisphere, we find the evidence on this point more satisfactory. We may observe, in the first place, that the area over which bronze has been used for implements appears, in so far as we have at present been able to trace it, to be continuous, extending over the greater part of Europe, Egypt, Assyria, and some parts of Siberia, India, and China, from which latter country some few bronze weapons have lately been added to the British Museum. Mr. Theobald, of the Geological Survey of India, also mentions in a paper read to the Royal Asiatic Society,* that bronze axes are found in the valley of the Irrawady, where they are held in such veneration as rarely to be procurable; and Sir Walter Elliot has shown me some bronze implements which he found deep beneath the soil in cutting a canal in the valley of the Ganges. Bronze is wanting in Africa; in America, with the exception of Peru and Mexico; in the north of Sweden and Norway, and, I believe, in the greater part of the northern districts of Russia and Siberia, though with regard to Russian and Siberian bronzes, our information is still very deficient. And here I may observe that I speak only of bronze as applied to tools and weapons; its use for other purposes may have been introduced at any subsequent period of the world's history; but the presence of a bronze weapon implies either total ignorance, or at least an imperfect knowledge of the means of hardening the more useful metal for this purpose,—iron.

Those who, wish for more detailed information as to the evidence upon which the succession of the stone, bronze, and iron ages has been determined, would do well to refer to Sir John Lubbock's remarks upon this subject, in *Prehistoric Times.* It may, however, be useful to enumerate briefly some of the chief points which have been adduced in support of the opinion that the employment of these materials corresponds to successive stages in the development of civilization in Europe. 1stly. Not only do the Roman writers mention iron as being the metal used by them in their time, but they also speak of its employment by the barbarian nations of the north, with whom they came in contact, and the word "ferrum," *iron*, was with the Romans synonymous with sword. 2ndly. Although numerous finds of iron implements of the Roman period have been discovered in various parts of the world, there has been no authentic and undoubted instance of a weapon of bronze having been found associated with them, or with Roman pottery or coins. 3rdly. Bronze implements are most abundant in Denmark and Ireland, countries which were never invaded by Roman armies, whilst they are exceedingly rare in Italy. 4thly. The ornamentation of the bronze implements is not Roman, but pre-Roman in character. 5thly. On the other hand, the numerous finds of bronze weapons which have been discovered have never been associated with iron, except in cases where the nature of the iron implements show them to have belonged to a period of transition. 6thly. The pottery associated with bronze-finds is superior to that found with stone implements, but inferior to that of the iron age, and the potter's wheel was unknown during the stone and bronze ages. 7thly. Silver is found associated with iron, but rarely if ever with stone or bronze. 8thly. No coins or inscriptions of any kind have been found with bronze implements. 9thly. In the Swiss lakes, settlements associated with stone and bronze have been found near each other, as for instance Moosseedorf and Nidau, 15 miles apart; in the former, bronze is entirely absent, in the latter, it was used, not only for articles of luxury, such as might denote a more wealthy class, but also for implements of common use, such as fish-hooks, pins, &c.; it is improbable that so marked a contrast in the civilization of two settlements so close to each other should have existed during the same period. 10thly. The implements and ornaments of the bronze-finds are more varied in form, showing an advance in art upon those appertaining to the stone age. 11thly. The bronze-finds are marked by an increase in the number of domesticated animals, and an entire absence of some of the wild animals of the earlier period, and they are also more clearly associated with traces of agriculture. 12thly. In the Danish peat bogs, successive strata are found overlying each other, denoting changes in the vegetation of the country; in the lowest and earliest, are found the remains of pine trees, which now are foreign to the soil; above which are strata, in which oak was the prevailing tree, and at the present time the oaks have been superseded by beeches. These successive strata correspond in a general way to successive stages in the civilization of the inhabitants; in the pine-bearing strata, implements of stone are found; with the oak trees, implements of bronze, and higher up, implements of iron. It has also been attempted to trace a somewhat similar succession of periods in the gravels and alluvium of the torrent of Tinière, in Switzerland; but the evidence in this case is not considered so satisfactory as in that of the Danish peat bogs.

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* "Journal of the Asiatic Society of Bengal," vol. xxxiv, p. 126. July, 1865.

In Chaldea, the transition from stone to bronze has been traced by the relics found in the soil, iron being then used only in small quantities, and chiefly for ornaments, as amongst the Ancient Britons in the time of Cæsar.[*] In Egypt, where both bronze and iron weapons have been found in the tombs, the transition from bronze to iron is marked by the colour of the weapons in the paintings, and dates, according to Sir Gardener Wilkinson, about B.C. 1,400. Hesiod speaks of an age of copper, when the black iron did not exist. Homer also alludes frequently to copper or bronze implements, and when iron is mentioned always speaks of it as requiring much time and labour to fabricate it. Then we have the well-known passage from Lucretius, so often quoted in reference to this subject, in which the three ages of stone, bronze, and iron are mentioned;[†] and Strabo mentions the Lusitanians as being armed partly with copper or bronze weapons.[‡]

Many other quotations might be given from ancient authors to prove that the existence of a bronze age preceding the use of iron was known to the ancients, but I will not occupy your time further with this part of the subject, seeing that others far more competent to deal with it than myself have failed to derive much information of value from this source. There is often considerable difficulty in determining the exact meaning of the writers, when speaking of the material of which weapons are composed, the same word being sometimes used to express copper, bronze, and iron. In fact it may, I think, safely be said that notwithstanding the large amount of useful information that may be obtained from the study of the early writers, there is no more fruitful source of error than the attempt to apply ancient history and tradition to the elucidation of prehistoric events. Modern science, and our fuller appreciation of the value of evidence, has thrown far more light on prehistoric times than ever fell to the lot of the ancients; and it is for us, therefore, to correct their errors, and not to be misled by them.

Professor Max Müller, in the second series of his "Science of Language," has, however, drawn some important conclusions on this subject, from the etymology of words representing metal, of which it may be useful here to give a brief abstract. Quoting Mr. E. B. Tylor's work on the Anahuac, he says: The Mexicans called their own copper or bronze *Tepuztli*, which is said to have meant originally, hatchet; the same word is now used for iron, which the Mexicans first became acquainted with through their intercourse with the Spaniards. *Tepuztli* then became a general name for metal, and when copper had to be distinguished from iron, the former was called red *Tepuztli*, and the latter black *Tepuztli*. The conclusion, he says, which we may draw from this, viz., that Mexican was spoken before the introduction of iron into Mexico, is one of no great value, because we know it from other sources; but applying the same line of reasoning to Greek, he says—here, too, *chalkós*, which at first meant copper, came afterwards to mean metal in general, and *chalkeús*, originally a copper-smith, occurs in the Odyssey in the sense of a blacksmith, or worker of iron. What does this prove? It proves that Greek was spoken before the introduction of iron. The name for copper is shared in common by Latin and the Teutonic languages, *æs*, Latin; *aiz*, Gothic; *êr*, old high German; *erz*, modern German; *âr*, Anglo-Saxon; and the same word is represented in our English word *ore*. But the words specifically used for iron, differ in each of the principal branches of the Aryan family. At the same time the words originally representing copper come to be used for metal in general, and in some cases for iron. In Sanskrit *ayas*, which is the same word as *æs*, came to be used for iron, a distinction being made between dark *ayas* or iron, and bright *ayas* or copper. *Æs* in Latin, and *aiz* in Gothic, came to be used for metal in general, but was never used for iron. *Aiz*, however, according to Grimm, gave rise to the Gothic word *eisarn*, meaning iron. In old high German *eisarn* is changed into *îsarn*, later to *îsan*, and lastly to the modern *eisen*, while the Anglo-Saxon *îsern* is converted into *îren*, and ultimately to *iron*. The learned Professor sums up his researches on this subject as follows:—"We may conclude," he says, "that Sanskrit, Greek, "Latin, and German were spoken before the discovery of iron, that "each nation became acquainted with that most useful of all metals "after the Aryan family was broken up, and that each of the Aryan "languages coined its name for iron from its own resources, and "marked it by its own national stamp, while it brought the names for "gold, silver, and copper from the common treasury of their ancestral "home."*

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[*] "Five Ancient Monarchies," vol. i, p. 120.

[†] Arma antiqua, manus, ungues, dentesque fuerunt
Et lapides, et item sylvarum fragmina rami,
Posterius ferri vis est, ærisque reperta,
Sed prior æris erat, quam ferri cognitus usus.—V. 1282.

[‡] Strabo, b. iii, c. iii, 6.

These remarks point to a very remote period, and to an Aryan origin for the first knowledge of copper and bronze, but on the other hand much has been written in favour of a Semitic origin, especially by Professor Nilsson, who believes that he has discovered traces of that people even on the coast of Norway.

The employment of war chariots, which are known to have been used by the Britons, and vestiges of which have been found in their graves, imply, it is said, Semitic influence. Much stress is also laid upon the resemblance of some of the ornaments found on the Danish and other bronzes to those in use by the Phœnicians. More especially the spiral ornaments which Professor Nilsson traces to that source, through the engravings on weapons in the bronze age tumuli. Against this, however, it may be urged that the spiral ornament has a very wide distribution, extending over modern Africa, ancient Egypt, Greece, China, New Guinea, Mexico, and South America, and even to New Zealand and the Asiatic Isles. In illustration of this I have arranged upon Plate XXXIII a series of illustrations of spiral ornaments from various countries, showing how universally it is distributed over the globe.

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* Max Müller, "Science of Language," 2nd series, pp. 229 to 237.

Fig. 12, is from a New Zealand canoe in my collection; Fig. 13, from a club brought from New Guinea by the Commander of the "Rattlesnake," in 1849, and now in my collection; Fig. 14, from China; Fig. 15, from ancient Egypt; Fig. 16, from Greece; Fig. 17, from a Danish bronze sword; Fig. 18, from an Irish bronze brooch in my collection; Fig. 19, from the Swiss lakes, figured in Dr. Keller's work; Fig. 20, an iron ornament in my collection from Central Africa; Fig. 21, an iron ornament on a club, from the Bight of Benin, West Africa, in the Christy Collection; Fig. 22, an ornament on a wooden arrow-head, in the Christy Collection, probably from one of the Melanesian isles; Fig. 23, from Hallstatt; Fig. 24, a cane arrow-head from the Amazons, South America; Fig. 25, a spindle whirl from Mexico; Fig. 26, on a bronze shield from the Caucasus; Fig. 27, an ornament on a bracelet from Hindustan, in the British Museum; Fig. 28, an ornament carved upon the stones of New Grange, in Ireland; Fig. 29, from a New Zealand canoe. Compare the two last figures with Fig. 30, a stone weight in my collection lately fished up on the coast of Kent, whilst dredging for whelks; the ornamentation so closely resembles the New Zealand pattern, and at the same time that of the stone carvings of the European tumuli, that considering the circumstance of its discovery, it is purely a matter for conjecture whether it is to be referred to the antiquities of this country, or has been dropped overboard by some vessel returning from our South Pacific colonies. We see from these examples that the spiral ornament cannot be regarded as belonging exclusively to any one race; it is a contrivance derived simply from the coil of string, the source from which, and also from straw plaiting, nearly all barbaric ornamentation had its origin; it is a proof merely of barbaric origin, an evidence of continuity from the earliest periods of art.

Mr. Franks in his remarks at the Paris Meeting of the International Congress of Prehistoric Archæology, has summarily disposed of the question of Phœnician ornamentation, by observing that the Phœnicians were copyists, taking their style from Egypt, Greece, or Rome, according to the fashion of the period, and that in point of fact a Phœnician style of art has never existed.

Amongst those who have upheld the theory of the origin of bronze from Phœnician sources, may be mentioned Mr. Howorth, in a paper lately published in the sixth volume of the "Transactions of the Ethnological Society;" and Sir John Lubbock, though not committing himself to the same view as regards the origin of bronze, has nevertheless been at the pains of ably defending the ancient authors who speak of Phœnician intercourse with Britain from the attacks made upon them by Sir George Cornewall Lewis.

This being the existing state of our knowledge in regard to the introduction of bronze, and the variety of opinion on the subject being, as we have seen, considerable, the task before us will be to ascertain as far as may be possible from the implements themselves, the history of their origin, by examining carefully their construction in the various regions in which they occur, and by tracing the geographical distribution of those details of form which show evidence of connection, thereby to determine, if possible, the sources from which they were derived. Whatever degree of veracity we may be disposed to attribute to early history, we must at least admit that the implements have this advantage over written testimony of any kind, that they cannot intentionally mislead us. If we draw wrong inferences from them the fault is our own. We shall find the evidence very fragmentary as yet, but sufficient to prove that it affords a valuable source of information whenever sufficient materials are collected to enable us to work out the problem to its legitimate ends.

On the present occasion I propose to confine my remarks to showing, by means of the accompanying table (Plate XXXII), the distribution of some of the commoner varieties of the copper and bronze celt, an instrument which, like its prototype in stone, appears to have been employed both as a tool and weapon for all the various purposes to which it was capable of being turned, and to have been used not merely as a hatchet and battle-axe, but also to have been sometimes hafted on the end of a straight handle, to be used as a spud or crowbar, and even perhaps, as some of the forms appear to indicate, as a spade in tilling the ground.

The table is arranged upon the same plan as Plate II of my last lecture, and is intended to serve as a continuation of Plate I of the same lecture, showing a further development of the same weapon. The successive developments are arranged in order by classes from left to right; the several localities are separated by horizontal dotted lines, by means of which are seen the various types prevalent in each locality, in so far as I have been able to obtain drawings from published sources; there can be no doubt, however, that the table is still very imperfect, and that considerable additions may be made to it hereafter. On the left, in Class A, will be found celts with convex surfaces, identical in form to those constructed of stone, the relative antiquity of which is shown by their being almost invariably of pure, or nearly pure copper. It has been suggested that this form may have been adopted on account of its being more easily produced by beating the copper, and that its resemblance to the stone celts is not necessarily a proof of age; but there is no reason why Class B should not be as easily formed as Class A by this means, and many are so formed, as may be seen in the table. Moreover, Fig. 3a is a *bronze* celt of the earlier form, taken from *Prehistoric Times*, and as this must have been cast in a mould, its peculiar shape can only be accounted for by supposing it to have been constructed in imitation of the stone celts. In passing from Class B, a gradual development of form may be traced, commencing with a slight stop or ridge across, and rudimentary flanges along the side of the shaft of the blade, developing in size and improving in form, no doubt, as the art of casting bronze became gradually perfected.* These stops and flanges are at first raised on the surface of the blade, but by degrees, the same purpose is effected by sinking a groove in the blade, to receive the handle, thereby economising the metal, and producing a more symmetrical form; the flanges were at the same time bent over, and ultimately cast with a cavity on each side to receive the handle, and obviate the necessity for binding on the celt with thongs. This led by degrees to the ultimate perfection of the weapon, by the introduction of the socket type, which is associated with weapons of iron, and is sometimes itself constructed of that metal.

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* Sir Richard Colt Hoare found four of these celts in the Wiltshire barrows, with rudimentary flanges along the side edges of the blade that had been formed by beating, and similarly formed flanges have also been noticed upon celts from Ireland, thereby leading to the supposition that Class B may have been converted into Class D in this way, before the casting process was applied to the formation of the flanges.—A. L. F.

The order of development here adopted is in the main that followed by Sir William Wilde, in his catalogue of the Museum of the Royal Irish Academy, but I have omitted all mention of branch varieties, as they do not serve my purpose of illustrating the continuity of development, though they are valuable in showing the connection between localities.

Although the course of development appears to have followed the order here indicated, it is not unlikely the earlier forms may have continued in use, and may even have continued to be constructed at the same time as the later forms. The earlier and less complicated types being easier of construction, and being equally serviceable for some purposes, would continue to be made, in the same way that smoothbores and rifle barrels, row boats, sailing-vessels, and steam-packets, continue to be used simultaneously in our own time.

The progress of development of this weapon will be better understood by a detailed reference to the figures.

Reference to the Figures in Plate XXXII.

COPPER, BRONZE, AND IRON CELTS.

Class A.—Copper celts from various localities, having convex surfaces, in form resembling those of stone.—Figs. 1, 2, and 3, from Ireland, *in my collection.*—Fig. 3a, a bronze celt of the same form, from Le Puy, France, *Prehistoric Times, p.* 27.—Fig. 4, copper celt found at Blengow, Mecklenberg Schwerin Museum, *Horæ Ferales.*—Fig. 5, copper celt from the lake dwellings of Sipplingen, Switzerland, found embedded in a coating of clay (mould?). See *The Lake Dwellings of Switzerland, by Keller*, translated by J. E. Lee, *p.* 121, *plate* xxix—Fig. 6, copper celt found in an Etruscan tomb, and now in the Berlin Museum. See *Catalogue of the Royal Irish Academy, bronze, pp.* 367, 395.

Class B.—Copper and bronze celts from various localities, having flat concave sides, and a rectangular cross section, showing a gradual enlargement of the cutting edge.—Figs. 7 to 12, copper celts from Ireland, *in my collection* showing a gradual enlargement of the cutting edge.—Figs. 13, 14, 15, ditto, *ditto* of bronze, the sides more concave, and the cutting edge more expanded.—Fig. 16, bronze celt, of similar form, from Denmark (*Ajbildninger af Danske Oldsager og Mindesmærker ved A. P. Madsen, Hefte* iii, *Fig.* 1).—Fig. 17, copper celt from Steinfurt, in the collection of Professor Dieffenbach, at Friedberg, *Lindenschmit, Plate* 3.—Fig. 18, ditto of copper, found near Mainz, Museum of

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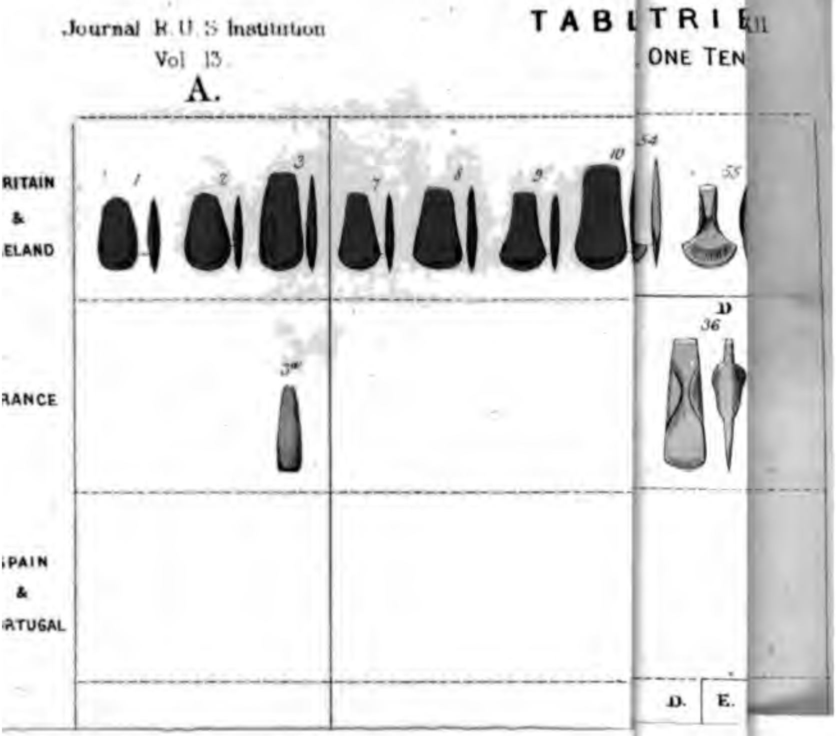

Mainz, *Lindenschmit*, *Plate* 3.—Fig. 19, the same form of bronze from near Mainz, *Lindenschmit*.—Fig. 20, the same form of bronze from Italy, *British Museum*.*—Figs. 21, 22, 23, the same form of copper from Hungary, *Keller*, *p.* 219, *Plate* lxviii.—Figs. 24, 25, 26, similar forms of bronze, with rectangular holes, from the Island of Thermia, Greek Archipelago, *British Museum*.

CLASS C.—Bronze celts of the same outline as Class B, but having a cross ridge or stop on both faces, to prevent the blade from burying itself in the handle.—Figs. 27, 28, bronze celts from Ireland, *in my collection;* this form is common to the British Isles.

CLASS D.†—Bronze celts, having four longitudinal ridges or flanges, one on each edge, but no cross stop. The flanges are for the purpose of fixing the blade in a bent handle; they exhibit a gradual development of the flange, and an expansion of the cutting edge, which latter takes a semi-circular, and in some cases nearly a circular form.—Figs. 29, 30, from Ireland, *in my collection* showing front view and section.—Fig. 31, from Versailles, *in my collection*, with section.—Fig. 32, from France. See *Matériaux pour l'Histoire de l'Homme*, with side view.—Fig. 33, from Loyette, Department of Isere, from *Horæ Ferales*, front view.—Fig. 34, from the South of France, *British Museum*, the blade very circular.—Fig. 35, from Alps, in Ardèche, *British Museum*, the circular form of the blade still more developed. This form appears peculiar to the neighbourhood of the Rhone.‡—Fig. 36, from France; see *Matériaux, &c.*, with side view.—Fig. 37, from Denmark, *in the British Museum*, of copper; this form is rarely found in copper, with section.—Fig. 38, from Denmark, of bronze, from *Madsen's Afbildninger, &c.*, *Hefte* iii.—Fig. 39, ditto with semi-circular blade, *Madsen*, *Hefte* iii.—Fig. 40, from Hessen, and now in the collection at Hanover, *Lindenschmit*, *Hefte* i, *Taf.* iii.—Fig. 41, from near Baltringen, *Lindenschmit*.—Fig. 42, from Neinheilingen, in Thuringia, *British Museum*, with section.—Fig. 43, from the Terramara Beds, Castione, Switzerland; with section, *Keller*, *Plate* lix.—Fig. 44, from Unter Uhldingen; with section, *Keller*, *Plate* xxix.—Fig. 45, from the Terramara Beds, Castione; with section, *Keller*, *Plate* lix.—Fig. 46, from the Terramara Beds, Castione; with section, *Kellèr*, *Plate* lix.—Fig. 47, from Hallstatt, in Austria, *Das Grabfeld von Hallstatt in Oberösterreich und dessen Alterthümer von Dr. E. F. von Sacken*, *Taf.* vii; with side view.—Fig. 48, ditto, *ditto*, found with the body of a child.—Fig. 49, ditto, the shaft of bronze, and the blade of iron, from Hallstatt.—Fig. 50, the same form in iron, also from Hallstatt, *in Mr. John Evan's collection.*—Figs. 51 and 52, similar forms, in bronze, from Italy, *in the British*

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* I have been enabled to take drawings of these celts in the British Museum, through the kind permission of Mr. A. W. Franks.

† The forms included in classes D, E, F, and G, are commonly known under the name of *paalstab* or *palstave*, a word of Scandinavian origin, said to have designated the weapons employed by some northern tribes for battering the shields of their enemies. Iron implements like the Irish *loy*, and called *paalstabs*, are still used in Iceland, either for digging in the ground or breaking the ice.—*Catalogue of the Museum of the R. I. Academy, Bronze*, p. 361.

‡ Horæ Ferales.

Museum.—Fig. 53, the same form, from Telsch, Vilna, Russia, *in the British Museum;* with two sections.

Class E.—Bronze celts having both the cross stop and the longitudinal flanges. In the earliest form, the cross stop and flanges are raised upon the faces of the blade, as in class D. In the more improved form, the upper part of the shaft of the blade is hollowed so as to answer the same purpose and economise the metal. Fig. 54, from Ireland, with rudimentary stop and flanges, *in my collection.* Fig. 55 and 56, ditto *ditto*, with rudimentary stop, the flanges more developed, *in my collection.* Fig. 57 showing a development of both stop and flange, ditto, *ditto.* Fig. 58 showing the stop and flange further developed, and the metal of the upper part of the blade slightly sunk, ditto, *ditto.* Fig. 59, a further development of the same, the metal of the upper part of the shaft of the blade reduced to a minimum.—Fig. 60, the same form as Fig. 54, from Denmark, *Madsen, Hefte* iii.—Fig. 61, from near Mainz, *Lindenschmit, Taf.* iii.—Fig. 62, from the Museum at Wiesbaden, *Lindenschmit, Taf.* iii.—Fig. 63, from Altona, in Courland; this form has some affinity to Class G, but is introduced here on account of the expansion of the blade.—Figs. 64, 65, and 66, from Italy, *in the British Museum*, the metal of the shaft slightly sunk to produce a stop.—Fig. 67, from Fiesole, Italy, the metal part of the shaft further reduced.—Fig. 68, from Baron von Stackelberg's collection, *in the British Museum*, also described in *Klemm, Werkzeuge und Waffen, p.* 103, *fig.* 180, said to be from Greece, but its close resemblance to those from Italy is remarkable.

Class F.—The same form as Class E, but having the flanges bent by hammering over the stop; the flanges appear to have been cast upright, as in Class E, and to have been bent over the cleft handle after hafting; by this means the necessity for binding the blade on with thongs was obviated. This class forms a transition to the socket type.—Fig. 69, 70, 71, from Ireland, *in my collection.*—Fig. 72, from the Royal Irish Academy collection, having a loop on the side. *See Catalogue, R. I. A., Bronze, page* 379. The introduction of the loop appears to be synchronous with the abandonment of the binding, the overlapping flanges answering that purpose by enclosing the bent portion of the handle, and requiring only that it should be fastened by the loop to prevent its falling off the end of the handle.—Fig. 73, from Denmark, *in my collection.*—Figs. 74, 75. from Denmark, *Madsen, Hefte* iii.—Fig. 76, from the Museum at Hanover, *Lindenschmit.*—Fig. 77, from the Museum at Munich, *Lindenschmit, Taf.* iv.—Fig. 78, from Möringen, Switzerland, *Keller, Pl.* xli.—Fig. 79, from Nidau-Steinberg, Switzerland, *Keller, Pl.* xxxv.—Fig. 80, from Hallstatt, *Von Sacken.*—Fig. 81, from Italy, *British Museum.*

Class G.—The pocket type: the bent portion of the handle in this case was retained in its place by pockets cast on each side of the shaft of the blade; it seems doubtful whether this or Class F is to be regarded as the nearest approach to the socket type. In Class F the overlapping was produced by hammering the metal; but Class G is a further advance in the casting process.—Figs. 82 and 83, from Ireland, *in my collection;* the latter with loop, the pockets or pouches to receive the points of the bent handle are shown in the sections.—Fig. 84, from France. See *Matériaux pour l'Histoire de l'Homme.*—Fig. 85, found 12 leagues south of Oviedo, Spain, *in the collection of the Society of Antiquaries.*—Fig. 86, from Andalusia, Spain, *British Museum.*—Fig. 87, from Denmark, *Madsen, Hefte* iii.—Fig. 88, from the collection at Munich, *Lindenschmit.*—Fig. 89, from the collection at Hanover, *Lindenschmit.*—Fig. 89a, an iron celt of the same form, still in use by the Kalmucs, Siberia, *Prehistoric Times, p.* 26.

CLASS H.—The socket type. In some of the specimens of Class G, as for example, Figs. 82 and 83, the metal portion of the shaft of the blade dividing the two pouches is reduced to a minimum. The next step was to do away with it altogether and enlarge the sides of the pouches so as to form a single socket. By this means the bent handle no longer required to be cleft to receive the blade, but was inserted whole into the socket, producing greater firmness, each blow of the axe serving to fix it more securely to its handle. The loops, seen only occasionally on classes F and G, are almost invariably present in Class H.—Figs. 90, 91, 92, 93, 94. Socket celts of bronze, from Ireland and England, *in my collection;* the form with square sides is very uncommon in Ireland.—In Fig. 92 a representation of the overlapping flange of Class F is cast on the surface of the socket.—Fig. 94a, a socket celt of wrought iron with loop, from Merionethshire, *British Museum; Archæologia Cambrensis, vol.* i, *third series, p.* 250.—Figs. 95 and 96, the same forms from France. See *Matériaux, &c.* The square sided celt is common in the north of France.—Fig. 97, from Alemquez, Portugal. *Col. Société des Achit. Portugais.*—Fig. 98, from Denmark, *in my collection.*—Figs. 99, 100, Denmark, *Madsen, Hefte* i.—Fig. 100a., an iron socket celt, from the moss of Nydam, in Slesvik, of the iron period, and believed, from the Roman coins found with it, to be of the third century,* *Denmark in the early Iron Age, by Conrad Engelhardt, Pl.* xv.—Fig. 101, from the collection at Hanover, *Lindenschmit.*—Fig. 102, from the Museum at Mainz, *Lindenschmit.*—Fig. 103, socket celt of iron, from Golssen, *Klemm, Fig.* 195.—Fig. 104, socket celt of iron, from Thuringia, *Klemm, Fig.* 194.—Fig. 105, of bronze, from Unter Uhldingen, Switzerland, *Keller, Pl.* xxix.—Fig. 106, of iron, found near Marin, Switzerland, the socket formed by beating over the blade on one side only; the socket is not quite completed. See *Keller, Pl.* lxxi.—Fig. 107, the same form of iron, found near Marin; the socket is closed and completed all round, *Keller, Pl.* lxxi. These specimens in iron may be regarded as connecting links between classes F and H. Viewing the occurrence of iron celts of this form, it appears not impossible that the introduction of the socket type, and the sudden abolition of the central division, may have been suggested by the use of the more malleable metal, by means of which the fabricator acquired the art of forming a socket by bending over the metal on one side; the inutility of the central division would thus become apparent.—Fig. 108, bronze socket celt with loop, from Hallstatt, *Von Sacken.*—Fig. 109, exactly the same form in iron, from Hallstatt. A portion of the wooden handle is still shown in this specimen.—Figs. 110 and 111, bronze socket celts, from Italy, of a variety peculiar to that country, *British Museum*.—Fig. 112, socket celt of copper, from Hungary, believed by the author to be the only known specimen of pure copper. *Keller*, *Pl.* lxxviii.—Fig. 113, bronze socket celt, from Hungary, *British Museum*.—Fig. 114, bronze socket celt, with two loops, from Kertch, *British Museum*.—Fig. 115, bronze socket celt, from the province of Viatka, Russia. See *Matériaux, &c.*—Fig. 116, bronze socket celt with two loops, from the Oural, Russia.—Fig. 117, mode of hafting, Classes A, B, and C.—Fig. 118, mode of hafting, Classes D, E, F, and G.—Fig. 119, mode of hafting, Class H.

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* *Prehistoric Times*, p. 9.

In a paper lately read to the Society of Antiquaries by Dr. Thurnam, he has drawn attention to the fact that none but celts of the most primitive type, viz., those belonging to classes B, C, D, and the most rudimentary form of class E, have been found in the British tumuli. Scarcely a single instance of the more developed palstave or of the socketed celt has as yet been discovered, the only exceptions being a bronze socket celt, found in a tumulus on Plumpton Plain, near Lewes, and a diminutive bronze socket celt found in a tumulus at Arras in the Yorkshire wolds; these Arras barrows are known, however, to belong to the iron age, having produced, amongst other articles composed of that metal, the iron tire of the wheel, and trappings of a war chariot. We learn from this that the discoveries in the tumuli confirm in point of time the order of development inferred from a consideration of the implements themselves.

From the foregoing detailed description of Plate XXXII, we are enabled to draw the following conclusions, viz.:—1stly. That in each of the divisions of Europe therein represented, traces of the development of the celt, from its simplest to its most complex form, have been discovered, the earliest forms being in imitation of those of stone, and being not unfrequently constructed of pure copper. Where some of the connecting links are wanting in the table there is reason to suppose the absence of those links may be the result of imperfect information, and does not necessarily imply a flaw in the continuity of development. 2ndly. That, notwithstanding the simultaneous development which appears to have taken place in different countries, we may nevertheless observe slight differences in the details of construction, which are sufficient to give a distinctive character to the celts of each separate region. Thus, for instance, the celts from Ireland are, as a general rule, shorter and less elegant in form than those found on the Continent. Class C, consisting of stop celts without wings, though common in Great Britain and Ireland, is, so far as I have been able to ascertain, unknown on the Continent. On the other hand, Class D, having wings without stops, is rare in Ireland, but common in France, Denmark, Germany, and Switzerland. The development of this class of celt into a nearly circular edge, as represented in Figs. 34 and 35, is peculiar to the south of France, though traces of it are observable in the celts from Germany, Fig. 40. Class E, having both stop and flange, is found in a more rudimentary stage in Ireland than elsewhere. The

palstaves of this form, having shoulders on the side of the blade, are peculiar to Italy and Switzerland, Figs. 66, 67, and 68. Class F, with overlapping wings, is but slightly developed in Ireland, but is fully so in Italy, Germany, and at Hallstatt. Class G, the double pocket variety, has its head-quarters in the north-west of France, but is also known in Ireland, Denmark, Spain, and Germany; it is, in so far as I have been able to ascertain, unknown in Italy. Class H, the socket type, varies greatly in different countries, the square form, Figs. 93, 94, 95, 96, 100, and 102, is exceedingly rare in Ireland, but common in France. The socket celts from Italy, Figs. 110 and 111, are of peculiar type, and evidently derive their form from the winged palstave of the same country, Fig. 67. Socket celts of iron have been found at Hallstatt, in Switzerland, Denmark, Germany, and North Wales. The representation of the overlapping wings, cast on the surface of the socket celt, Figs. 92 and 101, is common in England and Germany, but exceedingly rare in Ireland. The double-looped socket celt, Figs. 97, 114, and 116, appears to be especially characteristic of the Eastern provinces of Russia and Siberia, though found occasionally elsewhere.

In attempting to account for the varieties which I have described in the details of construction, coupled with a general uniformity of design throughout the entire region of distribution of these weapons, we may, I think, draw an exact parallel between the development of bronze celts and the development of the forms of cannon between the fourteenth and the nineteenth centuries. From Europe to China we know that the form of cannon has developed upon the same plan. In the same way that the overlapping wings of the palstave were represented on the faces of the socket celt, so the rings of metal which bound together the bars of which the ancient bombard was composed, were represented on the surface of the cast bronze cannon which superseded it. In every country the general type of development of cannon has been the same, but the details of construction have varied in each. Even in our own time the introduction of breechloaders has been synchronous throughout Europe; but the French and English cannon are not perfectly identical. Now, the cause of this is sufficiently well known. There has been constant intercommunication between the several countries throughout the whole period of the development of this weapon. Each new improvement as it occurred has been communicated from one country to another, either by contact in war, or by peaceful intercourse, but each country has fabricated its own weapons, and has by that means contrived to give them a national character.

So in like manner we must assume that the development of the nze celt extended over a long period of time; that each new im-vement was communicated from tribe to tribe and from nation to ion; but that each country manufactured its own implements, and ed in the construction of them. The proof that this was the is found in the circumstance of moulds for casting them having found in different countries. Fig. 31, plate xxxiii, represents a mould, found at Ballynahinch, co. Down, Ireland, and figured in the Catalogue of the Royal Irish Academy; it is adapted for casting celts of the Class B. Fig. 32, a stone mould for Class G, found at Montaigu, near Valoignes, Normandy, and is taken from a cast in the Museum of the Society of Antiquaries. Fig. 33, a stone mould for Class H, from Kilkenny, Ireland. Fig. 34, two halves of a bronze mould for Class E, from Morges, Switzerland, figured in Keller, *Plate* xxxix. Fig. 35, two halves of a bronze mould for Class H, found in the Forest of Bricquebec, Normandy, in the Museum of the Society of Antiquaries. Fig. 36, one-half of a bronze mould for Class H, from England, figured in the Catalogue of the Royal Irish Academy, bronze, page 393. In the three last specimens it will be seen that the mode of fitting the two halves together, so as to prevent the escape of the metal, is by means of a ridge on one-half, fitting into a groove in the other. It is improbable that a contrivance so identical as this should have arisen independently in the three countries. Further proof of connection is shown by the identity of the ribs in the interior of the sockets of celts belonging to Class H. Figs. 37 and 38 represent sections of socket celts from Ireland, the former showing three, the latter one, longitudinal rib of raised metal running from the bottom of the socket for some distance up the side of the interior of the socket. Fig. 39, is the section of a socket celt from Denmark, in my collection, having one rib of the same kind. It has been suggested that these ribs represent the interstices between slices of the core, by means of which the socket was formed in casting; if so, the cores must have been constructed of some hard material, cut in slices, in order to facilitate their removal from the socket when formed. Several objections may, however, be urged against this; in the first place, no such cores have ever been discovered, which tends to the supposition that the cores must, in all probability, have been constructed of clay; in the second place, it will be seen by reference to Fig. 20 that this celt has only one central rib; if, therefore, the rib was formed by the metal pressing into the interstices between the slices of the core, it is evident that the core in this case had only two slices; but it will be seen that the aperture of the socket expands towards the bottom, and it would have been impossible, therefore, to extract the core if it were divided into only two parts.

The theory of core slices must, therefore, be abandoned, and we are driven to the conclusion that the ribs must have been intentional, either to give strength to the celt, which is unlikely from the great thickness of the metal, or to form channels for the passage of the metal in casting, or, what is more probable, to serve the purpose of gripping the portion of the wooden handle which fitted into the socket, and preventing its shifting with the blows of the weapon. Fig. 39 represents cross ribs at the bottom of the socket of a celt from Denmark, in my collection. Whatever may have been the purpose for which the ribs were formed, their identity in the implements of the two countries serves us as an additional proof of intercourse between them.

Although moulds for casting celts have not been found in Denmark, there is evidence to show, from vestiges of scoriæ that have been found, that they were there cast in clay, as indeed they must probably have been to a great extent in other parts of Europe.

It would be premature to speculate upon the primary sources of the bronze civilization of Europe, until we have examined carefully the distribution of the other weapons belonging to that period. This much may, however, I think, be said with respect to the geographical region of bronze celts, that they belong more especially to the north and west of Europe; they have never been found in any of those countries which were occupied by the Phœnicians, nor have we any sufficient reason for believing that they were common in Greece. We have, therefore, no evidence whatever for supposing that the north of Europe derived the first idea of these weapons from either of those nations. We certainly have only negative evidence as yet for affirming that they did not, but the burden of proof must rest with those who have attributed them to the Phœnicians. To what extent they were employed in Russia and Northern Siberia, is a point which we have not as yet sufficient evidence to determine. I think, however, I am justified in saying that those hitherto discovered in Siberia are of a late type, belonging chiefly to the socket variety, and that they are there often associated with weapons of iron. I trust, however, to have an opportunity of entering more fully into this subject on a future occasion, when treating of the weapons of the later bronze, and early iron periods of Europe.

ON MITRAILLEURS, AND THEIR PLACE IN THE WARS OF THE FUTURE.

By Major G. V. Fosbery, V.C., H.M. Bengal Staff Corps.

It has been so often, and so convincingly stated, that the loss of life in each fresh contest stands rather in an inverse than a direct ratio to the perfection of the arms made use of, and so evident a good to all engaged results from any limitation of the duration of war itself, that I shall not commence this paper by any apology for such attention as I have paid to a class of weapons which are called infernal or inhuman, only by superficial reasoners, or by those who fail to comprehend the lessons conveyed by military statistics.

The arguments which condemn a warlike instrument simply on the grounds of its destructiveness to life, provided that it neither adds new agony to wounds, nor new terrors to death itself, are, if logically pursued, simply retrogressive, and even if not recommending by implication a return to the bow and arrow, at all events point to the old times of protracted wars, and deaths from fatigue and disease, far exceeding in number those caused by the weapons of an enemy. We can, therefore, afford to set them on one side, or rather, we are bound to neglect them altogether, and seriously consider any invention which, under the conditions above laid down, promises us a more certainly destructive fire than that attainable, *cæteris paribus*, by the arms at present included in our war materiel.

I hope to show as I continue, good reason for believing that the Mitrailleurs belong to this class, and to prove that they must, therefore, possess for us an interest which justifies me in calling attention to the whole question, as one likely sooner or later to become of grave importance.

I will, therefore, commence by giving a short definition of the arms which I propose to consider, with a sketch of their rise and progress, describing such of them as have come under my personal observation.

From this I will proceed to detail the effects which may reasonably be expected from them, comparing these effects with those of the weapons of our present field equipment, and conclude by a summary of the considerations which would seem to assign them a definite place in the armaments of the future, both naval and military. Should I fail in convincing all of the necessity, which some already proclaim to exist, for the adoption of such an addition to materiel already extensive and complicated, I shall in any case have fairly laid before my readers the main points of a question which at the present moment largely occupies the attention of those among military men, both at home and abroad, whose ideas are neither retrogressive nor stationary.

First then as to the definition of the mitrailleur; and here I think it scarcely out of place to complain a little of the poverty of our military technology, which contains no equivalent for this term, one coined I will admit, but coined immediately on the production of the weapon itself, and admirably expressive of its effects. With us the *mitrailleur* remains either an adopted word; is rendered "machine gun," which hardly conveys the idea; or again, Americanized into "*battery*," as in the case of the "*Requa*" or "*Gatling*," gives us still less the notion of a single instrument.

Colonel H. H. Maxwell, of the Royal Artillery, in the preface to his admirable translation of Colonel Marey's memoir on swords, makes, I remember, a similar complaint when he finds himself compelled to express the term "*Armes blanches*" by fifteen English words in order to give its full signification to the title of his author. Till, however, the wit of some genius finds us a true English equivalent, mitrailleurs, mitrailleuses, machine guns, or batteries, they must remain, and as such I shall proceed to describe them. Mitrailleur, the term I have adopted in the title of this paper, perhaps best of all expresses what is intended, namely, a weapon producing a hail storm of comparatively small projectiles; and to avoid confusion, I shall apply it to these inventions indiscriminately, whether or no in my opinion all are equally deserving of the title.

From very early times the idea of uniting in a single mass, or upon a rigid framework, a considerable number of barrels of small calibre, to be fired simultaneously or in rapid succession, has been frequently entertained, and now and again carried out with considerable ingenuity.

Colonel Martin, late of the 4th King's Own, in 1860 invented and brought forward a "war truck" and "rifle battery," fitted with a number of independent barrels, the former of which would take an intermediate place in the scale of such inventions somewhere between Fieschi and the Requa battery, which indeed is probably little more than an adaptation of his principle. Again, in 1862, General O. Vandenburgh, of the American Army, lectured in this Institution on "A New System of Artillery, for projecting a group or cluster of shot."* His gun, the details of which were very carefully worked out, and regarding the history of which I have lately learned several curious particulars, resembled in general principles the mitrailleur Favchamps, and though inferior to that weapon in the use of loose powder, and in the method of ignition, still bears a strong family resemblance to both the Montigny and French mitrailleurs. General Vandenburgh was, however, in advance of his time, the metallic cartridge was as yet unknown, and though he proved himself thoroughly to understand the considerations which give to such instruments their special value, his system in its original condition would prove but of little service as a weapon of war.

Other and older arms of this nature are to be found in the Rotunda at Woolwich, in the Tower, in the museum of this Institution, and in other collections of curious inventions. The machine of Fieschi was perhaps the first of them which produced any notable effect, and still forms the type on which several later weapons have been modelled. I think, however, notwithstanding the claims of Favchamps and others to originality of invention, and even some partial successes in practical experiment, the mitrailleur as a weapon of war was impossible until the metallic cartridge had been brought to its present perfection, and that we need concern ourselves neither with claims nor weapons anterior to that date, which indeed is a very recent one.

I am aware that a great number of inventors would disagree with me, when I state my opinion, that I am disposed to consider many an invention as I would a mass of metal, objectively it may be, because potentially valuable, but subjectively as useful to us, as was the wedge of gold to Crusoe in the solitudes of Juan Fernandez, and I would therefore award fully as much credit to him who forms it into a sword or a ploughshare, that is who makes it practically available for the ordinary necessities of life, as to him who dug it out of the original hill, or reduced it by fire from its primeval combinations.

Many inventions have remained useless and impracticable until supplemented by a fresh discovery, or by some trifling improvement, the combination being, however, always the work of some head clear enough to understand the full value of the first idea, and more than that, what was needed to bring it to a successful and practical issue.

The latter are the men who, fully as much as the former, deserve our gratitude, and should any be disposed to attribute the invention of the Requa battery to Fieschi, the Agar and the Gatling to the originators of revolvers, the Claxton to Herr Dreyse, or the French and Montigny guns to M. le Capitaine Favchamps, all that can be said is that in older hands these inventions were clearly unfit for the purposes of war under our present conditions, and that it has been reserved for those whose names they now bear, to render them so in greater or less degree according to the effects which they are capable of producing, and the complication or simplicity of the elements required to produce these effects.

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* See Journal, vol. vi, p. 377.

The guns which I propose to consider in the present paper are the Agar, the Claxton, French, Gatling, and Montigny, giving to each a notice sufficient to render its general principles fairly comprehensible, and briefly examining such peculiarities as seem to make each more or less fit for purposes of war.

I have arranged them, as will be seen, alphabetically, and we will therefore commence with the Agar. This gun, of American invention, should be classed with the Claxton and Gatling, as it involves the principle of feeding up to a barrel, or limited number of barrels, and discharging through it or them a considerable number of rounds with great rapidity, as distinguished from the Favchamps, French, and Montigny plan of employing a considerable number of barrels, through which a greater number of rounds is perhaps discharged, but with less fouling, heating, or wear and tear, to any individual barrel. The Agar then consists of a single rifled barrel, of a calibre something between ·568 and ·577, *i.e.*, about the bore of the Enfield. This barrel is firmly screwed into a massive breech piece, and is capable of being quickly replaced by one of two or three spare barrels carried with the machine.

The barrel and its accompanying machinery are mounted on a carriage similar to that which carries a mountain gun or light field piece.

The axle at its extremities carries boxes of ammunition, and on the centre the gun itself, placed on a ball and socket joint, strongly constructed, and giving it horizontal and vertical training through very large arcs.

The ammunition consisted originally of a large number of steel chambers charged with powder and ball, and carrying a cap on a nipple screwed into the rear end. These were placed in a rectangular box, and allowed to roll one by one down an incline which conducted them to a recess formed in rear of the barrel of the gun. A handle connected with a system of cogged wheels being turned, the charged chamber escaped from its provisional position and fell into a carrier, where it formed a prolongation to the barrel itself, a wedge rising behind it secured it firmly for an instant in this position, and whilst it was so held, a hammer falling exploded the cap, and that chamber was done with.

As the handle continued to revolve, the wedge relaxed its pressure, a lever threw the discharged chamber into a shoot leading to another receptacle, and a fresh chamber instantly took its place, the operation being repeated from 100 to 120 times per minute.

In theory nothing could be prettier, and I have myself seen it performed with capped but unloaded chambers with the most beautiful precision.

When the metallic cartridge was invented, it was easy to substitute for closed chambers small cylinders of steel, each of which contained a Boxer cartridge, which was fired by precisely the same mechanism.

The only thing forgotten seemed to be that when using loaded chambers, and firing at the rate of 100 discharges per minute, the flame of 7,500 grains of exploded powder, and nearly 7lbs. of lead, would pass through this single barrel in that time. The effect on trial proved to be that the barrel grew first red and then nearly white hot, large drops of fused metal poured from the muzzle, and the firing had to be discontinued from fear of worse consequences.

The inventors subsequently adapted to it an ingenious apparatus by which the superabundant heat was rapidly carried off by a stream of air driven through the barrel and through a casing which surrounded it, but I have no reason to believe that such a contrivance could fully answer their expectations—a faulty principle cannot be made good by ingenious devices; nor even that did it do so, the machine as a whole could be applied on any considerable scale to war purposes. One or more of them were, I believe, used with some show of success during the American war for the defence of bridges or narrow passages, and a mantlet carried on the carriage very effectively protected the gun against all small arm projectiles.

This variety of mitrailleur may nevertheless, I think, be fairly considered as disposed of, as not coming up to what is required either in simplicity or power, whilst its supply of ammunition, were there no other reason against it, would be obviously difficult to keep up for any continuous service.

The next in order is the mitrailleur Claxton, also the invention of an American. On this weapon I was lately requested to report for the information of Her Majesty's Government, and having carefully examined the arm itself, its ammunition, and accessories, I am unable to speak of it much more highly than of the Agar. It consists of a revolving framework carrying six or eight rifled barrels, any pair of which may be readily adjusted in front of two sliding breech actions, thus forming for the time being two breech-loading rifles placed side by side. A species of pump-handle placed between them is worked by one soldier, whilst another feeds them with cartridges, and the rapidity of the fire is limited by the physical ability of the soldier to work this handle.

The machine is feeble in construction, slow in action, furnished with ill-conceived projectiles, and mounted on a carriage which a week's service would destroy. The firer is protected, however, by an ingenious shield, and seated on the trail in a way which gives him a good position for the service of the weapon. Although in its present state this arm is undeserving of much attention, there are several things about it worth noticing by those who would thoroughly study the whole subject. Its rate of fire is about 80 to 90 shots per minute, and it is made in two sizes, the larger throwing ½lb projectiles, and the smaller the Chassepôt bullet.

Of the French mitrailleur it does not, I think, become me here to say much, for though I have had means of learning in considerable detail its distinguishing features, and am acquainted with its breech-action, barrels, cartridge, and charge, still the secret is so jealously guarded by our friends and allies, that it would be an ill return for much official kindness and hospitality shown me, to publish that which after all I have unofficially and indeed almost accidentally learned. I can fairly however state, that the weapon is a most formidable one, it is admirably constructed, and equipped for service, and will, I doubt not, produce, if brought into action, effects almost as astonishing as those of the breech-loader, and cause a general impatience to be possessed of the new arm.

The French gun is of the same class as the Favchamps and Montigny, solidly constructed, and capable of enduring hard service.

Their mitrailleur batteries are, I believe, already numerous, and consist of eight guns each; each gun is served by three men chosen from the sous-officiers of the Horse Artillery of the Imperial Guard, and with this complement it should throw about 300 shots per minute for five or six consecutive minutes, to very considerable ranges, and with an admirable trajectory.

The only fault I should feel disposed to find, would be that for its power, the gun is somewhat heavy, and although I fully understand the intention of this weight, I should be inclined from what I have observed during my study of the subject, to think that less metal, even with their charges of powder, would fulfil every requirement, and permit a handier and more manageable weapon to be brought into the field.

To the French in any case clearly belongs the credit of having been the first to appreciate the importance of this subject, and in spite of the many grave difficulties which attended their earlier essays, to conquer them by laborious constructions and experiments, and produce a weapon far in advance of anything possessed at the present moment by any one of the civilized powers.

That it will fulfil their anticipations I have but little doubt, and should it do so, it will to the full justify the outlay and labour expended on its construction, and the cost of the mystery with which it has been their care to surround it.

The Gatling battery, so called, comes next on the list. It belongs, as I have said before, to the same general class as the Agar and the Claxton, and although possessing in some degree the faults which distinguish these, is a far better considered invention, and one worthy of being placed greatly in advance of any other which embraces the same general principles. It consists of ten rifled barrels made with extreme accuracy, and truly and strongly fitted to a framework, which is again surrounded by a metal cylinder.

An opening in this cylinder permits the entrance one by one of the cartridges, which are of drawn metal and solidly constructed, and to this opening is adjusted a curved box containing a certain supply. As each cartridge falls in turn through the opening, it is carried by internal wheelwork to its appropriate barrel, forced into it, fired by a plunger or striker actuated by a spiral spring, and the empty case is withdrawn. The latter falls through a small distance, and eventually passes out of the casing through an aperture constructed on its lower side. The wheelwork which conducts the cartridge to its place, and, in fact, takes charge of it from the moment of its escape from the upper box until its rejection at the lower side of the gun, is actuated by a handle fitted to a squared key placed at one side of the breech. The rate of fire is regulated by the speed at which it is possible to turn this handle and keep up the cartridge supply.

I have seen a statement made by Mr. Broadwell, the European agent of this invention, to the effect, that certain improvements having been made in the weapon, it is possible, according as the operator possesses greater or less skill, to fire from it 700 or 500 shots per minute—a most astounding result if true. When, however, we reflect, that in order to produce this result either 70 or 50 shots per minute will have to pass through each of the ten barrels, we must, I think, allow that his enthusiasm for the invention has led him into an exaggeration of its performances. Even supposing it possible to fire with it, 700 shots during one minute of time, it must be evident that many minutes would elapse before it would be possible to fire again, owing to the heating and fouling of the barrels which would necessarily take place. For whilst we know that it is possible with well-constructed ammunition to fire slowly from a rifle several hundred shots without cleaning the arm, the conditions are greatly changed when the temperature is so much raised, as would be the case with a rate of discharge such as that above mentioned. On the other hand, one of these improved Gatlings was lately officially tried at Vienna, in a mitrailleur competition held there. The rate of fire was found to average 280 shots per minute, instead of 500 or 700, and almost every minute produced some interruption of the firing, owing to the sticking of a cartridge which failed to reach its proper barrel, or of a case, which became jammed in the mechanism, after leaving it. It must be evident that *contretemps* such as these ought not to be possible in a weapon intended for field service; and admirably designed and constructed as the Gatlings undoubtedly are, I confess to feeling grave doubts as to whether, for war purposes, they will fulfil all necessary conditions. Whilst I have a right to express a private opinion, I have none to prejudge an arm which will, I believe, shortly be tried officially for the second time in this country, and I therefore say no more regarding it. The rate of fire is stated to be 500 to 700 shots per minute, as I have above said. It has been found hitherto not to exceed an average of 280 to 300, but the official trials about to be made will doubtless show whether or no the already attained results may in some way be largely exceeded.

I have pointed out the difficulty which lies in the way of any excessive rapidity to commence with, provided a continuous fire is desired, namely the small number of the barrels, and the heating and fouling which must take place, even should the mechanism work without hitch or hindrance.

This, even when perfectly clean and in the hands of its own representatives on an artillery practice ground, it has not been always found to do. Whether in the hands of soldiers, and on a field of battle it is likely to do better, can hardly be merely a matter of opinion.

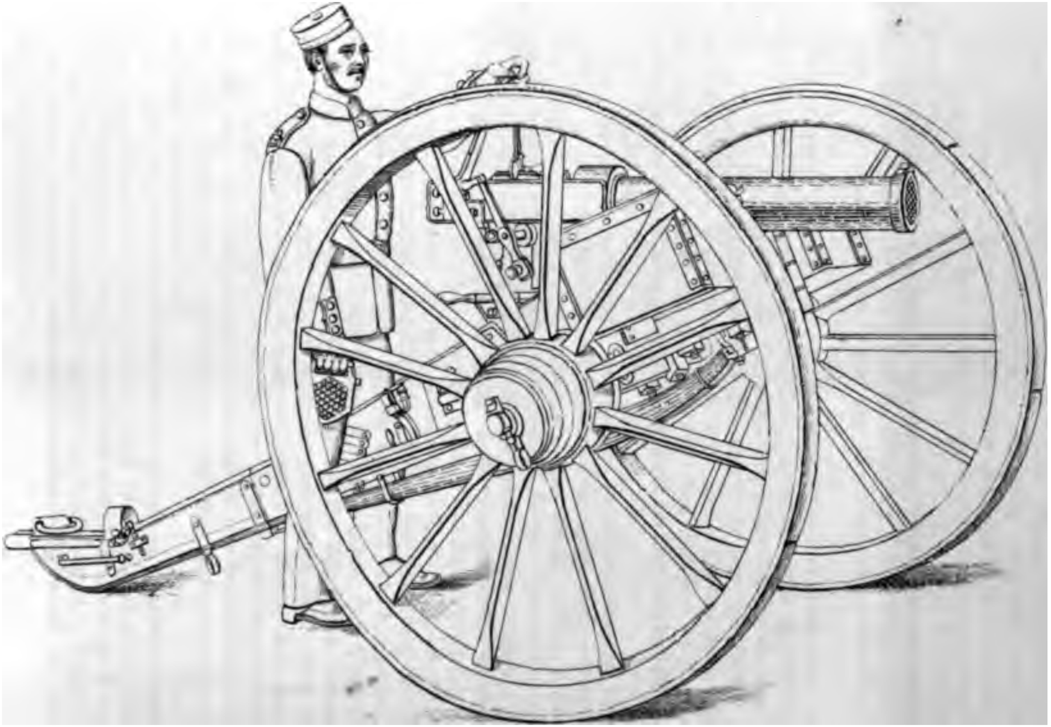
We now come to the mitrailleur Montigny, a representation of which is attached to this paper (Plate xxxiv). My name has, to a certain extent, been connected with this invention owing to my having been lately charged with the superintendence of one of them whilst in process of manufacture for the Government. I must, however, disclaim all share in the invention itself, which is entirely that of MM. Montigny and Christophe of Brussels. At the same time, I consider that in urging on M. Montigny the adoption of Mr. Metford's rifling, and his hardened expanding projectile, instead of the ill contrived, cannelured bullet formerly used with a rifling, but ill adapted to its object; in devising a system by which the cartridges are securely carried on service; and in changing the system of cartridge itself, I have been able to render the invention more suitable for the purposes for which it is intended.

The Select Committee which is about to sit on both this and the Gatling guns will, however, doubtless, shortly decide on their respective merits, and also on the far more important point as to whether or no arms of this nature will be added to our armament of the future. A short description of the gun above represented will close the first part of this paper, and I will then proceed to recapitulate such considerations as appear to me to bear on the mitrailleur question in its broader aspects.

The Montigny mitrailleur, of which a representation is given, consists of an assemblage of barrels contained in a wrought-iron tube, mounted much on the same principle as an ordinary field gun, which, indeed, it somewhat resembles in form. To this a massive breech action is attached, sliding between heavy iron plates. This is controlled by a jointed lever, which is here represented as raised by the man working the gun, and contains a simple contrivance for the separate and successive ignition of the cartridges. The cartridges are carried in steel plates, perforated with holes, corresponding in number and position to the chambers of the barrels, of which, indeed, when in position, these holes form portions, being bored and finished with the same tools and at the same time as the chambers themselves. These plates are about 11 millimetres in thickness, and when the cartridges (which are *central fire*) are dropped into them, they stand out at right angles in the proper position for introduction into the chambers of the gun. Grooves, formed on the face of the breech-block, receive the plate, which being dropped into them now advances or is retired with the breech-block itself.

The gun is here shown in the loading position; a plate of cartridges being now introduced, the gunner would depress the lever which he holds in his left hand, the breech block would advance, pushing each cartridge into its appropriate barrel, and finally become secured in its place beyond chance of accidental disturbance by recoil or otherwise. The contrivance which effects this is a very simple and perfect one. At the same time and by the same motion the whole weapon is set at full cock, ready for firing.

The gunner now quits the loading lever, which requires no further attention, and, grasping the firing handle, shown at the right side of



Mitrailleur Montigny mounted on 6 Pr Service Carriage the gun, awaits the order to fire. One second of time is sufficient to give a complete revolution of the handle and discharge the whole of the 37 barrels of which the weapon consists, but each may be fired separately and at any intervals of time. When the last barrel has been discharged, he raises the loading lever, thereby opening the breech and withdraws the empty cases by means of the plate which now performs the office of an extractor, or rather of 37 extractors in one. The plate is lifted from its grooves carrying with it the empty cases, and replaced by one filled with loaded cartridges, and the operation is repeated.

To open the gun, remove the empty plate, insert a full one, and re-close ready for firing, takes somewhat less than four seconds. It has thus been found possible to fire this weapon 12 times per minute, throwing therefore 444 rifle shot in that time.

This, I believe, to be the largest number ever yet thrown by a machine of like weight; though, as I have before said, others pretend to the possession of greater powers in this particular.

The Montigny gun has the enormous advantage of simplicity as compared with other systems; and in trials which have lately been made by the Austrian Select Committee and others, it was not found to be deranged by sand and earth thrown over it, or similar imitations of the everyday minor accidents of a campaign. It showed, I believe, in these respects a notable superiority over its rivals, as indeed my knowledge of their principles and construction would have led me to anticipate. The gun as at present constructed consists of 37 barrels of a calibre of ·534 inch, rifled according to the Metford system, which seems to possess a remarkable aptitude for this class of weapon.

The bullet weighs 600 grains, and is hard enough to penetrate without much deformation 29 half-inch dry elm planks at 60 yards from the gun. Its penetration at 100 yards would probably be greater.

The cartridges are by Fusnot, of Cureghem, near Brussels; but it carries the Boxer cartridge admirably. This the Gatling would not do with equal facility. The charge of powder is 115 grains, which might with advantage be increased to 125 or 130 grains; the bullet being made a little heavier at the same time.

The waggon and limber-boxes at present carry 3,034 rounds of cartridge, but might readily be made to carry more.

It has been found by experiment that the 37 bullets thrown by this gun in a discharge occupying one second of time, now cover, at 800 yards, a space about 10 feet in height by about 12 in width, whilst at 1,000 yards the base of the cone of dispersion is vertically somewhat, though little, over 12 feet in diameter.

When I had, in 1868, the honour of preparing for the Secretary of State for India a report on the same weapon in its original state, as to rifling and projectiles, effects such as these could not be produced even at 400 mètres, and yet so formidable were its performances at the ranges then attainable, that it seemed good to Her Majesty's Government almost immediately to order a specimen arm to be prepared for trial.

This weapon was prepared under my personal superintendence, and has been mounted at the Royal Carriage Factory at Woolwich, with such improvements as were readily attainable with the materials to hand.

I do not, however, hesitate to say that a gun on the same principle might yet be produced greatly excelling the present one in range and efficiency, and capable of still larger practical effects when used against troops upon a field of battle. For this purpose it would be necessary to re-model, not the form nor principle, but the details and proportions; and at a comparatively trifling expense we might thus in a short time be still further in advance of those who have up till now preceded us in their attention to and expenditure upon similar inventions.

I could in far greater detail describe the principles and performances of the mitrailleurs up till now invented or in use, and enter with greater minuteness into their history and progress. I have, however, I think, said enough to enable my readers to judge of them for themselves; they will see without difficulty the distinctions which exist between the two great classes into which they divide themselves, namely, those in which the cartridges are brought into place by machinery more or less complicated, and those in which cavities or chambers containing many cartridges at once are brought into juxta-position with larger numbers of barrels, and fired by comparatively simple means. In the latter class I should personally be disposed to see a greater chance of present success, and the hope of future progress; but in order to attain either the one or the other, the question will need to be most carefully considered to begin with, and it must be the care or the interest of some competent Officer, or body of Officers, to pursue it to a successful issue.

In the present state of warlike invention, no halt can be regarded as a permanent one, and those who look on their armaments, however apparently complete, as being in anything but a state of transition, or at least being unsusceptible of improvement in themselves, or addition to their accessories, will be found most wanting in the day of trial when most is required.

There has been, and with much reason, specially amongst the French and ourselves, a strong feeling in favour of the simplification of field equipment. With them it has governed for many years all the details of their land-service Artillery, which under the immediate eye of the present Emperor has grown into as simple and workmanlike, and at the same time practical and formidable, an armament as exists in the world. With us the feeling has been rather a reactive than a persistent one, and, like all reactions, will tend, if not carefully watched, towards the rejection of much that, had the principle been all along accepted and controlled, would have seemed useful or even necessary. The French, who are notoriously adverse to the introduction of anything, however good, which complicates in the smallest way their field equipment, or tends to render the service of either Artillery or small arms difficult in moments such as those which often decide the issue of great battles, have accepted the mitrailleur, a weapon to which the complications of the Armstrong field gun are as nothing. Nay, more than this, they are said, and I believe with truth, to have expended at least £200,000 on its production, the elaboration of its details, and the well organized secret manufacture, which has given it, in its now complete condition, to their service.

The same considerations which have led them to the adoption of this course should apply with increased force to ourselves, as will, I think, be seen from the arguments which follow, and a patient examination of the whole question. In order to enable us to make this, let us consider, to commence with, what this mitrailleur question really means, and why so much time, ingenuity, and money have been laid out on it. It is hardly credible that if, as some assert, field Artillery fulfils all the requirements of actual service, engineers of known capacity, and Officers of recognized talent, should pay such serious attention and recommend the expenditure of such vast sums, on that which, when produced, would complicate without rendering more effective, the materiel of war.

When, however, we perceive that in its wider aspects the question is one of whether or no machinery can take, in warlike operations, such a place as it has already done in the peaceful arts, and appear in the battle-field to the same advantage as it has done on the road, in the steam-ship, and in the factory, our wonder is diminished, and we see in this, as we see all around us in other matters, activity, because the idea which stimulates it is one of progress, and that, too, in the direction of the economy of labour and preservation of life.

If it be possible by means of a machine, not too liable to derangement, and not too complicated for the comprehension of the soldier, to make three or four men do the work of 120, the advantage must be self-evident.

It is not that we can afford to send home 116, retaining four and giving them a machine, as some would willingly have us believe, and as would be the case in a workshop or factory, but that we are able so to shelter and reserve the 116 that their lives are comparatively safe, and their powers unimpaired, during such time as their enemy refrains from coming to the charge or the bayonet-push, and that they are therefore more competent to repulse an assault, push an advantage, or complete a victory, than they would have been if harassed and decimated by long range fire, to which their strength had been exhausted by replying.

The obvious reply to this argument will be that it is the custom of war to commence every battle by the long range fire of artillery where such is practicable, and that of course common sense will always shelter infantry, if possible, until the very moment when their services are required.

Unless, therefore, some reason can be shown which gives the mitrailleur a decided advantage over artillery, you but advance a plea for a larger employment of that arm. Here, therefore, it will be proper to consider what artillery can and cannot do, and why we should propose an intermediate weapon for employment in the unfilled space which I hold to exist between it and the weapon of the infantry soldier, even under its most advanced conditions. That this space does exist, is believed by many who are far more competent to judge of the whole question than I am myself; indeed the efforts which have been made, and are making, to fill it, themselves testify to its existence.

It is rare in this very practical day of ours to find continuous, intelligent exertion used to supply a want that is purely imaginary, and rarer still, to find an effort made to create an artificial want by the perfection or abundance of the supply.

Let us therefore endeavour to see how it arises, and what are its limits, and in this way by localizing and defining, so to speak, the fault, we shall be the better able to judge of the remedy proposed, and its fitness for the purpose.

A prolonged trial of field artillery has, as most of my readers are aware, lately taken place on Dartmoor, and we have had an opportunity such as rarely occurs of judging of the effects producible by the weapons now in our hands.

It is a subject for regret that at all ranges within reach of the infantry musket, bodies of foot were not opposed to similar targets, and under similar limitation as to time, &c., as the guns, and comparative as well as positive data obtained, by which the relative values of the fire of the two arms might be ascertained, and hints for their economic employment afforded.

The broad results of such experiments as did take place are, however, now generally known, and the universal feeling seems to be one as much of surprise as disappointment at the meagreness of the effects produced, when compared with the powerful and ingenious apparatus, and the amount of skill and intelligence required to produce them. We now know that a system of defence of the most simple character is amply sufficient to protect infantry, when stationary, from the effects of our field guns; and when in motion that, except under circumstances rare enough now, and which will every day become more so, the most perfect projectile we have, will on an average only drive home 20 effective fragments, each capable of inflicting death or a severe wound into a close column at from 1,000 to 1,500 yards.

In order to produce these 20 fragments and render them efficient, many independent operations must be truly performed, and even then sudden gusts of wind, or considerable barometric variations, may render all of no avail by their influence on the flight of the projectile, by delaying or accelerating the burning of the fuzes. Under the most favourable circumstances, when employing time-fuzes, it is impossible to secure, even within moderate limits, a similar cone of dispersion of shrapnel bullets, or segmental iron, for any two successive shots at the same range.

The gun must be laid between every discharge, an operation demanding time and care, necessitating a clear view of the object, and all but impossible to get exactly repeated by the most highly-trained and skilful gunners when on an artillery practice-ground, and neither greatly pressed for time, nor deprived, in however small a degree, of that *sang froid* which few persons possess completely, when exposed to a lively fire, and endeavouring to crush it by the rapidity of their own.

The field gun can be fired but five times in two minutes with reasonable precision, and would, therefore, supposing no single shot to be thrown away, or less than to the full effective, produce in that time no more than 100 effective pieces of metal. So great, however, is the difficulty attending the adjustment and service of time-fuzes in rapid and sustained firing, when the ranges are apt to be constantly varied by an enemy's motion, that I have heard it asserted by able artillerists that under these circumstances the time-fuze ought never to be employed. We should then be forced back on the use of the concussion-fuze, which will ignite the bursting charge of the shrapnel or segment-shell only after the latter has come in contact with some body giving sufficient resistance to cause a slight but sudden diminution of the velocity of the projectile.

In action we find always two methods of getting this function performed, the one is to strike the ground at a short distance in advance of the troops intended to receive the benefit of the fragments; the other is to use the body of one of your enemies as the resisting medium. Both have certain disadvantages, though both are capable of producing great effects. So great and so rapid is the deflection of rifled projectiles after striking the earth, that it will frequently occur on any but the most favourable ground that the whole projectile will have taken up its new direction, whether vertical or horizontal, before the explosion has formed the fragments by which the effect is sought to be produced. Or again, the graze takes place too soon by a distance almost impossible to appreciate at the gun itself, or too late by a like distance, and the effect of the shot is equally lost.

Again, supposing the body of a soldier to be selected as the *pièce de résistance* by which the shell is to be exploded, he must, in order to act properly and efficiently, be the front rank man of a column or other deep formation; if the shell passes him by, and strikes no one until comparatively far into the column, its cone of dispersion will be a small one at its exit from the formation, and the effects not very considerable; whilst in firing at troops, either in loose order or in line, such practice would obviously fail to produce serious effects, whether moral or physical.

I have myself witnessed practice in Belgium with shrapnel exploded by graze, and though this was conducted on most favourable ground at large and lofty wooden screens, and at a distance of no more than 400 mètres, it was evident that a large proportion of the fragments would have wholly failed to produce any effect on a line, though considerable damage might doubtless have been done to troops in rear, supporting or in reserve.

In several instances the form of the surface, though consisting of sandy heath, and free from great irregularities of contour, and from surface stone, evidently deflected the projectile before the explosion was sufficiently matured (if such an expression can be admitted to explain an effect which is but a falling short of absolute instaneity), and the fragments were in large numbers carried high over the screens.

Still I will admit that, standing as we did behind a turf screen in front of the targets, and in a position to see the graze and burst of each shell, the practice had a very formidable appearance, and such as would have severely tried the courage of troops exposed to it. Always supposing it possible for field guns to be unlimbered and worked on an open plain within 400 mètres of a line armed with breech-loaders, the rapid, and on the whole accurate, bursting of the shrapnell, the rush of the liberated bullets, and the tearing and screaming sound of the angular fragments of iron, passing through and over the space supposed to be occupied by a line of living men, whilst it might actually perhaps produce less effect than that to be obtained from time-fuze practice, and still less than that obtainable when the line itself was fired at with concussion-fuze, would be calculated to shake the nerves, and in a measure demoralize an enemy more than either.

It is humiliating to human nature to be so often compelled to admit the large part that mere animal instinct plays in its greatest successes when achieved by large numbers, and how closely many of the heaviest reverses of an army resemble the mishaps of the flocks and herds. The boldness of a single leader, or of a front rank, will induce a herd to take a leap or face a danger, and as long as these go on, nothing short of death itself will prevent the remainder from following. In like manner a mob well led becomes for the moment as formidable as an Army, and its members as indifferent to peril, however much they may have been hitherto unaccustomed to contemplate or averse to face it.

Though we use our utmost efforts to substitute discipline for instinct, or rather subordinate the one to the other; with the most highly trained troops, we often find the latter wholly master them, and they will turn with the foremost files from the fire these are unable to face, or follow them to certain death with a courage derived from a similar instinct. Do what we will they will still rush at seeming impossibilities like a herd of antelopes, or stampede like the wild horses on a Mexican prairie.

There would thus seem to be a distinct reason, if once we abandon the use of the time-fuze for rapid firing in the field, for preferring with all its disadvantages the use of the concussion-fuze ignited by graze, to the practice of firing at the head of a column direct, and trusting to its demoralization by the effects on the followers rather than on the leaders.

In any case the Artillery question is involved for the present in many difficulties which may be overcome sooner or later perhaps, but still a growing conviction exists that the gun is unable, with all its improvements, to do as much against *troops* as for its weight, and the large target its horses, waggons, and detachment offer, it should do, or as up till a comparatively late period all believed it did.

For certain purposes it is most admirably adapted, and it would be impossible to diminish by a single gun our present field equipment without loss of efficiency corresponding to such reduction.

Against anything short of shot or shell, certain kinds of dĕfences to be found in any enclosed country would be amply sufficient, and neither mitrailleur nor infantry fire would dislodge the defenders of a garden wall, or render untenable an entrenched post of the weakest construction. Either one or the other would, however, probably far exceed it in effect on troops deployed in the open, or for the defence of a defile, a hollow road, a bridge, or a causeway. As I have before said, it is a matter for serious regret that data for some really practical comparative estimate of the values of Artillery and Infantry fire on exposed targets have not been made, and that we are thus to a certain extent in the dark as to what a given number of guns might be expected to do when opposed to a given number of troops, or supposing either arm to be employed, as may occasionally happen without assistance from the fire of the other, in what proportions they should be employed to effect by their fire a certain object, *i.e.*, a requisite amount of destruction at definite ranges. In the ever-varying conditions of our armament, the data obtained by the practice of ten years since, are of no avail to us to-day; tactics are changed it is true to suit the changed conditions of range and accuracy given by the advance in the rapidity of fire and increased perfection of our weapons, but it must never be forgotten that whilst the introduction of rifling in the Infantry arm increased its range, so as almost to equal that of the unrifled field gun, and its accuracy of fire so as far to exceed it, the introduction of breech-loading to both weapons has multiplied the power of the musket by ten as regards rapidity of fire at short ranges, but has left the field gun where it stood.

Thus the unrifled field-piece could be fired three times per minute with ease, when the necessity for very accurate laying of the gun was not absolute—the muzzle-loading rifle perhaps not quite so much.

The breech-loading field gun has a range far exceeding that of any infantry weapon, but its rapidity of fire, that is, of *effective fire*, is by no means greater than that of the old smooth-bore. Now the rifled infantry musket, whilst losing nothing whatever in accuracy by its conversion to a breech-loader, has gained in rapidity of fire as 10 to 1.

The field gun has got accuracy, I will admit, of the most wonderful character, a range even greater than can be ever required in war except under very improbable circumstances, but has not advanced one iota in the rapidity of its service, and cannot now, in its most perfect condition, throw one shot more per minute than it did in the battles of the Peninsular war. It must follow from this that, whilst the rifling of both arms merely restored the relative conditions which had existed for years, and were first disturbed by the rifling of the infantry musket, the introduction of breech-loading to both has given to the one an advantage almost impossible to estimate without further experience, and adds to the other but an additional complication without any corresponding advantage.

The great advance made by us on the first introduction of the rifled field gun was in the projectile rather than in the weapon, and when we adopted it, the Armstrong segment shell, without doubt, contained the most formidable combination of parts thrown by any gun of equal calibre in Europe.

It is by no means certain even now that it does not for certain purposes maintain a superiority over anything yet devised. For all this we cannot help acknowledging that there will always exist in war situations not calculated to afford either to it or to the improved shrapnel of Colonel Boxer a fair chance of developing their full powers, The French system of working troops in the field, their loose order in advance, their rapid movements, quick firing, and the advantage they instantly take of the cover afforded either by conformation of the ground or natural shelter of whatever description, would place both at a great disadvantage, whilst their rapid concentration in the final rush on a post or battery would give the guns no opportunity for more than a couple of rounds at best, and these must be thrown in no hurried manner to tell properly and produce their due effects.

The French have adopted this system of tactics in order to avoid the destructive effects of the new guns. They have not done so, let us be sure, without a moral certainty that what has been shown to the world so freely at Chalons as the deliberate choice of the first military nation in Europe, will be copied with greater or less modification by others. We may rely upon it, I think, that no skilful player will allow a hint of his coming play to transpire, unless he is fully prepared for the move his adversary will make in consequence of such information. May we not then fairly infer that their possession of so large a number of mitrailleur batteries has rendered them confident, in case of their tactics being imitated, of being able successfully to deal with troops worked as theirs now are?

It may be said that this is mere hypothesis, and that a hitherto untried machine, or one at least untried on the field of battle, can give no such confidence to its possessors as such a theory as this would imply.

I speak with diffidence as to theory, but with confidence as to the effects of which mitrailleurs, well-designed and well-worked, are capable. For what is the fact? With the field gun in its best condition we produce per round 20 effective fragments or bullets, capable of inflicting serious wounds or death, and we can throw these into a column or other body of troops up to 1,500 yards. We can throw 2½ such rounds per minute under favourable conditions, or 5 rounds in two minutes' of time, that is 100 such effective pieces. When these pieces come to be analysed, we find that some are segments or bullets, some broken pieces of the envelope of iron which fits the gun and carries them up to their destination. We employ for the purpose at the gun itself a certain amount of apparatus for piercing the fuzes, cutting or otherwise adjusting them; or we employ a fuze already prepared, which depends on some careful adjustment of the gun itself for its efficacy. When all is done, about one-half of the weight of metal put into the gun, is finally effective at the object.

But if this is the case, and it would be difficult to prove that more is so, it must be evident that somewhere a great waste of material occurs.

For could a larger portion of metal be made effective, it is clear that it would be useless to carry into the field so large a weight as we now do in order to produce an equal effect; but if a less weight of metal would suffice, then also would a less amount of powder be required to drive it; a gun of smaller calibre might be used, and the whole of our field equipment would become easier to move, handier in the working, requiring fewer men and fewer horses for its transport and service; and, as a matter of course, both in a military and in an economical point of view, fitter for the service of the country.

So far is this now from being the case, that we find the 9-pounder guns of the horse artillery unable to produce the effects which we should wish to see, and a proposition entertained for exchanging them for 12-pounders, which will doubtless add to the efficiency of their fire, though the additional weight to be dragged must detract to a large extent from their mobility. Supposing for a moment such a change to be carried out, and a horse artillery battery of 12-pounders to be brought into action, not to breach a wall, batter a farm house, nor oppose an enemy's artillery, but merely to play upon troops either awaiting an attack or forming to make one, what do we find? We find guns weighing 900 lbs. each brought rapidly to the front with limbers and waggons weighted with at least twice as much powder, lead, and iron as will ever produce under the best of circumstances, either death or wounds to an enemy; and we find these deaths and wounds dealt out very slowly indeed, at the rate only of about 50 per minute, under these exceptionably favourable conditions.

If a "range-finder" is used, a minute and a-half is consumed in finding the distance of the enemy; if it be not used at any but the shortest distances, the fire is mere guess-work, and may be either good or bad, with a strong presumption in favour of the latter. Superior as our artillery is acknowledged to be, we can scarcely wonder, knowing what we know of its performances, at the failure of either the Austrian or Prussian rifled field services to influence largely the fate of the battles where both were so freely and ably made use of. Neither succeeded in any instance, as far as I am aware, in stopping the advance of infantry or even in greatly impeding the operations of cavalry in the field, though doubtless both were efficient and well served. The crowning victory of all was essentially one of infantry, and was gained in the face of a powerful and protected artillery, although, perhaps, this did not bear with as much power as it might have done on what after-events showed to be the true key of the position, and thus, in face of our horse-artillery fire—good as it is, we might expect troops to stand, and even an advance to be successfully carried out. If, however, it chanced that instead of six 12-pounder guns, with their 50 destructive pieces per gun per minute, the advance took place on a point occupied by a battery of mitrailleurs, would the case be different? I will grant that there would be no bursting of shell, and perhaps, till their power became known and acknowledged, comparatively little of that moral effect which attends a concentrated and sustained fire of artillery; but as regards the destruction occasioned by them—I cannot help feeling certain that it would exceed, up to certain ranges, that producible by any engine of war hitherto made use of which at all approaches them in handiness and portability, or which requires so little previous education for its management.

If the diagram which is appended to this paper be examined (Plate xxxv, fig. 2), the effects of a single discharge of a mitrailleur weighing no more than 400 lbs. at 800 yards will be seen; and at 1,000 yards its performance is almost equally satisfactory. Unfortunately, a miss-fire took place at this range, one of three which occurred during the firing of nearly 2,000 rounds of ball cartridge; there are therefore but 36 shots instead of 37 placed in a parallelogram about 10 feet in height by 12 in width, representing a rifle bullet of 600 grains to about every three superficial feet of surface. A successful shot with a time-fuze shrapnel might do the same thing, or even better for one shot; but it must be remembered, that the base of the cone of dispersion of shrapnel varies as the distance at which the burst takes place from the object, and that with the utmost care it is impossible, even on the practice-ground, to keep this distance absolutely the same for even two successive rounds. But with the mitrailleur the area covered by the discharge merely varies as the distance between the object and the gun itself; no failure of a fuze in its action, no miscalculation of a few yards only in the distance of the object, no fault of cutting, piercing, or adjustment of a good fuze by a well-trained man for a moment flurried in the heat of action, alters its operation in the smallest way, as is the case with the gun. At certain distances it gives groups of projectiles, each of them, be it remembered, of a definite weight and known penetration; and the size of these groups varies merely as the distance itself, but for the same distances is rigidly the same. By a simple mechanical arrangement it is now possible to place these groups, groups such as are seen in the diagram, in such a manner that the edge of one group shall just intersect the edge of that which preceded it, and to treat a whole line if necessary in this manner, giving to each section of 10 or 12 feet its one or two discharges, and proceeding to the next in regular succession. This contrivance is, however, one which will require to be worked either by the firer or by a second soldier standing at the gun. I have, however, proposed to fit to the arm a simple modification of my own invention, which, whilst in no way complicating it, will enable one man to fire the gun, distributing, if he pleases, the fire of a single discharge through a larger horizontal area than that due merely to the natural cone of dispersion, and at the same time commencing the next discharge in a fresh place in an enemy's line. For 12 of these discharges can be, without difficulty, made in one minute of time, and 444 bullets can be distributed over 1,332 superficial feet of an enemy's front at 800 yards with almost as much certainty as we have that the water from a steam fire-engine will, under normal conditions, rise so many feet in the air, or fill a given cubical space in a given time. Further than this, the distance of an enemy being once ascertained, effective discharges can be repeated as often as we please, although we are not again able to relay the mitrailleur through the prevalence of smoke, the darkness, or any other conceivable cause. The gun *must* be relaid between each discharge. The mitrailleur does not require it, but, having once been brought to bear on its object, will continue to pour forth discharge after discharge, covering, according to the range, a definite area with each, and distributing its fire horizontally with mechanical precision. The six 12-pounders would thus, supposing the gunners to be able to catch sight of their enemy between each discharge, and every

Fig. 1.

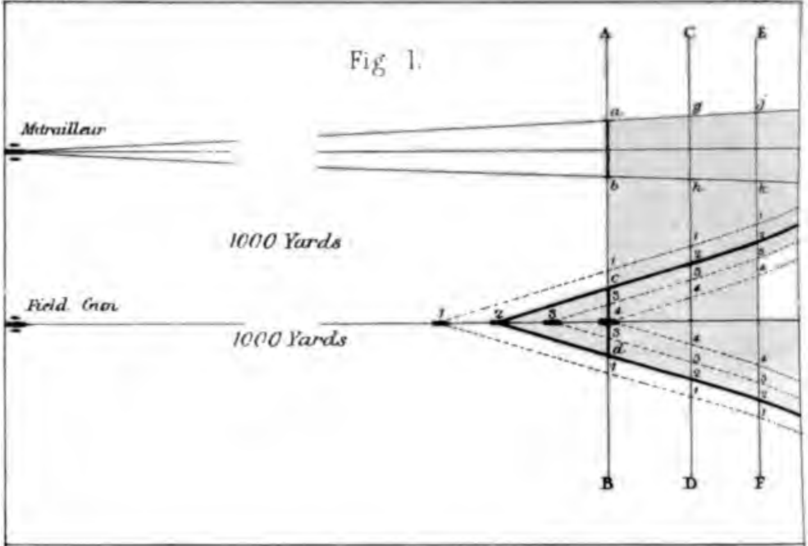
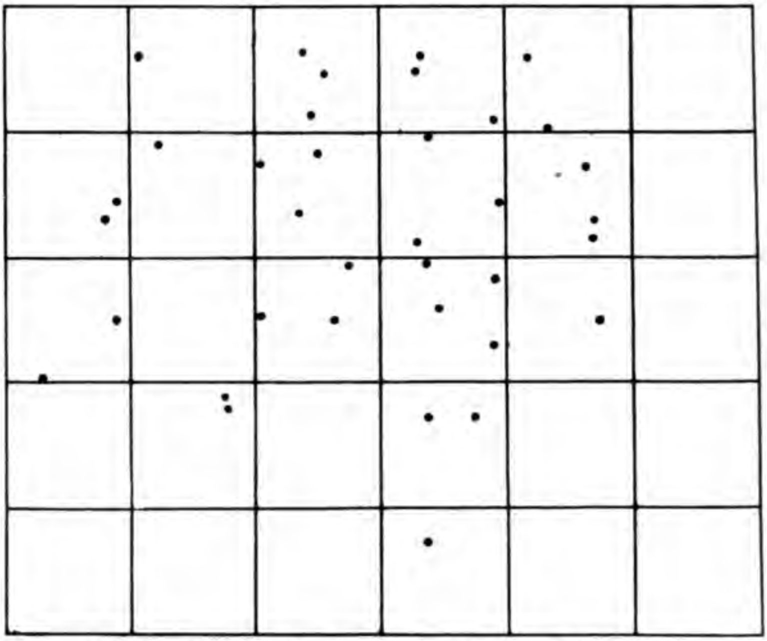


Fig. 2.



1 Plate of 37 Shots, fired as a Volley at 800 yards, at Woolwich, 36 hits. 1 misfire.

Mean absolute deviation 51 inches.

SIZE OF TARGET 18 × 15 FEET

J. Jobbins

shot to go well, throw into a body of troops 300 irregular but effective pieces per minute.

The six mitrailleurs having once ascertained their enemy's distance, would mechanically throw into a like body 2,664 rifle bullets of the same weight in the same time; would weigh half as much as the guns, or perhaps rather less, require half the number of men to work them, and one-third the number of horses to draw them, or with the same number of horses would be infinitely more mobile.

It would be difficult to find the troops who could face such a hailstorm as this, thrown even by a single battery. What would be the result of the concentrated fire of several batteries of mitrailleurs on any exposed formation I leave it to your judgment to determine from the data I have placed before you. A most distinguished Officer of artillery, whom I cannot name for obvious reasons without his permission, in discussing with me the mitrailleur question, in which he has taken much interest, asked which I should prefer for the defence of a bridge or other similar position, a mitrailleur, or a 12-pounder field gun, supposing the space to be defended to be some 1,000 feet in length.

I took the side of the mitrailleur, and he that of the gun, "for," said he, "I should fire direct at your instrument and knock it over, and you could do nothing of the sort." It appeared to me, however, that if both gun and mitrailleur were unloaded to commence with, the gun would never be loaded at all; if both were loaded, and the first shot from the gun failed to smash the mitrailleur, the gun could not be loaded a second time, nor would a horse or man belonging to it survive the first minute's practice from the weapon opposed to it. But it is only under exceptional circumstances that the mitrailleur could ever be opposed to the field gun. The latter from its superior range could always retire out of the range of the former, and with its heavy projectiles smash up machine, carriage, and all, at its leisure and with perfect impunity, even should the effective range of the mitrailleur be increased to 1,500 yards, as I believe it will be.

It is only when both are opposed to infantry or cavalry that the one would seem to assert its superiority over the other; that is, the fire of a mitrailleur will, within certain distances, always compare most favourably with the fire of shrapnel, both in the number of pieces taking effect and the regularity of their dispersion.

If there were no other reason for this than that shown in the accompanying diagram (Plate xxxv, fig. 1), I think that proof enough is here afforded of the truth of my statement. For let us suppose two equal spaces indicated by the dark lines *ab*, *cd*, on the general front, AB, of an enemy's line, placed at 1,000 yards from the guns, and that it be desired to render these spaces as dangerous as possible, that is throw into each the greatest possible number of effective projectiles of whatever nature.

Let us further suppose that such space corresponds to the natural cone of dispersion of the bullets thrown by the mitrailleur, which, at this range would be about 12 by 14 feet, *i.e.*, 12 feet in height by 14 in width.

Now it will be apparent that a miscalculation of distance, such as that due to the space between AB and CD or CD and EF, would affect comparatively little the horizontal spread of the projectiles, which will be directly as the distance from the gun itself, or again, that troops in support or reserve on those lines might suffer considerably.

In firing with shrapnel, however, the case is different, for, supposing the projectile exploded at the point 2, to give the requisite degree of dispersion to cover the space *cd*, on the line AB, to the best advantage, it must be evident that on the lines CD and EF, the dispersion will be too large to be efficient.

The same will be the case on the line AB with the premature burst No. 1, whilst 3 fails to cover the space desired, and 4 passes through the line as a single mass.

Nor does the matter rest here, for the dispersion is vertical as well as horizontal. In the case of the mitrailleur it remains a constant quantity for each distance, increasing only as the distance from the gun. In the case of the shrapnel the dispersion varies with the varying distance of the explosion from the object vertically as well as horizontally, and partakes of the same uncertainty in both aspects. As I before pointed out, this uncertainty in time-fuze-practice is a very serious matter, owing to the difficulty of obtaining the range with perfect exactness, and laying the gun and adjusting the fuze with precisely the same accuracy for each succeeding shot.

Nor will this uncertainty be by any means obviated by either of the descriptions of concussion-fuze-firing before described. Furthermore, the high degree of initial velocity which is maintained throughout flight by our rifled projectiles, whilst enormously increasing the effective ranges of shrapnel, adds to instead of decreasing the difficulties of fuze adjustment, by magnifying the effects of any trifling error, however introduced.

On the other hand, the guns, owing to their superior range, can be now withdrawn, when the ground is favourable for the purpose, beyond the ordinary range of infantry fire, or even beyond that of the mitrailleurs. As I once said on another occasion, *had the gun its choice of distance*, a duel between the most powerful mitrailleur and a comparatively light rifled field-piece could only end in favour of the latter.

But in order that the gun should gain this victory, it will be necessary, as it is easy enough to show, to place it in full sight of the weapon it attacks, and some 1,200 or 1,400 yards off, for at less than these distances the gun detachment would be unable to work it with the smallest degree of safety in face of the fire to which they would be exposed.

But it should be remembered that in action it will often happen that both sides are able to choose the ground on which to dispose the various arms for attack or defence, and that an Officer in command of a mitrailleur battery would probably as much dream of placing himself at such a disadvantage, as would a Colonel of cavalry of attempting to charge squares armed with magazine guns or breech-loaders.

Nor must we forget that in war there will always occur situations in which the 1,400 yards range, so admirably suited to the artillery requirements in a contest of this description, does not exist just where it is wanted, and that guns must either be brought closer in or remain out of action altogether. That, besides this, from its lightness it will always be possible to carry a mitrailleur into positions when no gun equalling it in power at its own range could be brought at all, and from the character of its ammunition, that also possesses peculiar advantages for easy transport.

It is in such situations as these that the mitrailleurs would find their special place, positions requiring a large amount of fire developed perhaps from a small, or comparatively small front, able in the short interval between the appearance of an enemy and his coming to close quarters, to pour in a far larger amount of fire, and with less troublesome conditions, than any other weapon; they could thus deal out to infantry a destruction of which the field gun is incapable *in the same time*, and could prevent any field gun from being placed in position to oppose them.

There are those who appear to forget the rapidly increasing importance that this *time* question will assume in all future contests; in many of the arguments used on one side or the other, in the whole breech-loading and magazine-gun controversy, it has been strangely neglected.

I have frequently been asked, "But pray, sir, what is the use of a gun that can fire 20 shots a minute? In five minutes your men would exhaust the whole of their ammunition, your guns be red hot, and the line engaged without a round of ball cartridge. No one should fire more than 6 or 7 shots in a minute, and a gun is useless, or even mischievous, which enables them to do so." Such questioners seem to me to lose sight of the fact that the power of discharging 20 rounds in one minute, conveyed also that of discharging 5 shots in 15 seconds, and that on those 15 seconds and the 5 shots per man fired in them, would often depend the forcing or the preservation of the key of a position necessary to the safety of an Army, or the repulse of an attack on lines or squares menaced by greatly superior numbers. In like manner the rapidity of fire of a mitrailleur battery must receive its due consideration. It may never be necessary to fire 12 rounds per gun per minute during any action they may be ever engaged in, but in their capacity for such rapid firing resides a power and an advantage which might at any moment prove inestimable.

It is on the final minutes and portions of minutes that the successes or failures of great movements as frequently turn, as on the ability, skill, and forethought employed in preparing for them. A fire of unexampled weight and severity, thrown in at a critical place and moment, will often be more decisive in its results on the fate of the day than whole hours of distant cannonading or long-range ball practice. It was in short intervals of an overwhelming rapid fire that the Prussians found their breech-loaders give them their most decisive advantages. In dealing with an enemy carrying similar weapons, these short intervals of fire, combined with rapid movements and probably with loose formations, are what will have to be looked for and provided against.

Deliberate and continuous movements, in face of either artillery or infantry, will become more and more impossible, and we shall have to prepare for short and rapid concentrations from extended order, or sudden rushes from cover, natural or artificial, which will give but little time for the use of any slow-firing weapon.

In dealing with such movements, the mitrailleur appears to me peculiarly adapted; loaded in four seconds and fired in one, with no interval for relaying, an automatic distribution of its fire, more effective than shrapnel at 1,000 yards, and as useful as canister at 100; ammunition which a well-instructed infantry soldier can comprehend and make use of with effect;—it would seem to fill satisfactorily the interval between artillery and infantry in a way that is much to be desired.

I should not feel disposed to think that mitrailleurs could be advantageously attached to artillery batteries as were smooth-bored howitzers, owing to the essential difference between the two natures of ammunition, and of the training required for their use, to say nothing of other questions of equipment, rapidity of movement, and difference of range. Nor, on the other hand, should their organization be mixed up in any way with that of foot regiments, as were certain field guns at one time. Infantry should never be hampered in the field by the necessity of keeping to ways practicable for wheeled carriages; they should not have to depend too much on the assistance of any fire but their own, nor should they be capable of being demoralized by the failure, destruction, or capture of any instrument from which they had expected too much.

Again, to look at the economical side of the question, whatever may prove to be the actual original cost of the mitrailleur itself, and this may or may not equal that of the rifled gun, highly trained and highly paid artillerymen are not needed for its service. It will travel with two horses instead of six. Three marksmen taken from the infantry, with a little drill, would be amply sufficient for its management; and furthermore, the cost of its fire per shot thrown is less than one-fourth that of the fire of shrapnel, for if we assume that the price of a 12-pounder shrapnel, with fuze and burster complete, as put into the gun, *exclusive* of the powder-charge, or friction-tube, is 6*s*. 8*d*., which is probably well within the mark, and that this shrapnel gives 20 effective pieces; then the cost of distributing these pieces on an enemy's front must be 4*d*. per piece, exclusive of its share of the powder-charge and friction-tube, of the pay of the gun detachment, and price and keep of the horses, and carriage generally.

The mitrailleur cartridges can be manufactured with a large margin of profit at £4 per 1,000; the price of each effective bullet, therefore, *inclusive* of charge of powder and detonation, is less than 1*d*., with, as I have shown before, less than half the number of less highly paid men for its service, and one-third the number of horses for its transport. 37 barrels bound up together no more become a piece of artillery, because they are fastened together and fired by a single man, than they would do had they remained separate and been fired by 37; nor because the machine travels on wheels and is drawn by horses, need it more necessarily be driven and worked by gunners than need a baggage waggon or a fire-engine. On the other hand, although the cartridges and individual barrels resemble those used by infantry, for the reasons given above, the two arms should be kept separate.

I have already compared its effects at its own ranges with those of the field-piece, and the following quotation from a thoughtful and well-written article in the *Standard* newspaper expresses as well as I could do the terms on which it is likely to compare with the fire of Infantry. Should these estimates be approximately true, the economy in using, and place in which to use the mitrailleur, will be apparent. After a description of the arm and its mechanism and ammunition, the writer goes on to say:—

"There can be no question on these two points, that such a machine " can be trained with far more accuracy and delicacy than ordinary " rifled small arms from the shoulder; and secondly, that a machine, " unlike a man, has no nerves to be disturbed. With regard to the " comparative values of infantry and mitrailleur fire, we are disposed " to place the latter higher than some who have written on the subject " have done. At extremely close quarters, and with arms of a high " degree of rapidity of fire, it is quite possible that infantry may deliver " a valuable and effective fire of from eight to nine shots per man per " minute. It may be doubted, however, very much, if with any degree " of training possible to be given to ordinary troops, an effective fire " of more than six shots per minute would be obtained at from 350 to " 400 yards. The rapidity of fire after this distance will doubtless " bear an inverse ratio largely increasing in its proportion to its efficiency. At 600 yards, four shots per man per minute might be made " to tell, and at 1,000 yards, perhaps not more than three; and this " because we are dealing with the error of the man, added to the mean " deviation of the weapon. The errors of judging distances may be " almost said to increase proportionally as the squares of the distances " themselves. We may, on the other hand, expect the mitrailleur fire " to bear throughout its ranges values approaching far more nearly " those due to the accuracy of the barrels of which it is composed, " and being fired also at a rate constant for all ranges, it is evident that " its proportional value increases enormously with the distance. Assuming the present Montigny mitrailleur of 37 barrels as a basis of " calculation, the rapidity at ten rounds per minute, and giving to each " barrel the same accuracy as the infantry musket, with, however, a " flatter trajectory and greater range and penetration, we can also " afford to place behind that gun controlling intelligence much above " that required to handle the infantry weapons. We shall probably " find as the result of practice, that whereas at 200 or 300 yards the " effects of the gun will be equal to those produced by the fire of some " fifty infantry soldiers, or at 1,000 yards it will do more actual work " than 200 or 250 muskets. Taking all circumstances into consideration, we are disposed, as matters stand, to place the value of a single " well-built mitrailleur on this construction, properly manned and " furnished, rather above than below, equivalent to 120 infantry. The " French have a more slowly firing arm, heavier, and of fewer barrels; " and these they have formed into batteries of eight pieces each. Such " a battery would equal in value of its fire, supposing these ideas to

" be correct, and the machine guns to be on Montigny's principle, at " least an infantry regiment of full strength, whilst there would be " this advantage, that only twenty-four lives would be exposed to the " enemy's fire instead of nine hundred and sixty. Let us take an " average country over which fighting on ordinary principles could be " conducted, place these eight mitrailleurs in position, with the regi- " ment lying down to cover them, and it must be evident that they " would be unassailable by any force of three times their strength, nor " would it be safe for artillery to approach them, supposing that in " order to do so the nature of the ground compelled them to open fire " within the effective range of the mitrailleurs. Under the present " changeful conditions of the art of war it is difficult to say what " form fortifications will assume, or how long a permanent position " will be tenable; but on the old system the one great difficulty was " to obtain a sufficient weight of small-arm fire at certain points; for " instance, salients and flanked angles. With the mitrailleur, this " difficulty disappears, for by it, the actual value of 120 men can be " compressed into the standing-room occupied by four, and with only " the exposure to fire of three of these."

This article was written before experience had proved a rate of fire of more than 10 rounds per minute to be obtainable from the Montigny mitrailleur, which has been assumed as the basis of calculation: with 12 rounds a minute, the argument would be still more in favour of the arm. In any case the intermediate place which I propose to assign to the weapon is contended for, and its adoption would be borne out by any further confirmation of the truth of these views, which it is to be hoped may soon be obtained from experiment. It is not, as I have already said, that we could hope to replace by such instruments a single field gun, but that those who in addition to their full complement of artillery shall carry into the field mitrailleurs also, and understand their position and true uses, will obtain an advantage which I should be sorry to see possessed only by that side to which I found myself opposed.

From a clever pamphlet on the mitrailleur, written for Colonel Claxton, by some foreign engineer, I translate the following passage:—

" Power will no longer exclusively be on the side of the big batta- " lions, but as machinery has rendered industry rich and prosperous, " so now whilst diminishing, or at least without increasing a war ex- " penditure, it is about to render small peoples and little states as " powerful for defence as are the great for attack."

Though I do not agree to the full in this statement, and should hold that to employ the mitrailleurs purely as defensive weapons would greatly detract from their value, still it touches on one of the most important sides of the question; namely, the multiplication of fire by mechanical means, and the saving of life and money so effected.

In conclusion, I must express my regret that I should have been unable to read instead of printing this paper, as the discussion which might have fairly been expected to follow, could not have failed to prove more instructive than my own deductions from the facts which I have had the honour to lay before my readers.

It was in contemplation of some discussion on the subject that I prepared much of this matter. For, even though it is well known that the French are in possession of many of these weapons; that almost every power in Europe has experimented with them; that Russia has ordered a large number, some of which she proposes to carry on the tops of her iron-clad ships of war;—attention has hitherto been but little directed to them in this country, and a valuable discussion tending to this object would be better provoked by a statement of the facts on one side, put as plainly as may be, than by a better balanced summary of every argument on both.

Thus I have not desired to dogmatize, but rather to put forward for consideration and discussion such points as seem to me to bear on the main question, seen from one point of view. Their position in the field I have endeavoured to show. Naval men will judge for themselves of the value of such inventions, securely sheltered and worked by a couple of men, in protecting the decks of their ships as contrasted with the huge and cumbrous rifle towers which some of them now carry. In repelling armed boats or sweeping an enemy's deck, their use would be, if exceptional, at least evident; and there are both on sea and land numerous positions where a fire such as that I have described would be most valuable, other than those I have enumerated or hinted at.

The invention in its present state is a comparatively new one, and like all new things will find many opponents simply because it is so, whilst the *status quo* will never want an advocate. Those who will divest themselves of this very natural prejudice will, I trust, see in it some points of value rendering it worth, at all events, patient investigation, and be careful, whether in its adoption or rejection.

There are other details regarding it which could hardly have been introduced into a paper like this, but which may be gathered from reports of mine on the subject placed at the disposal of this Institution by the kindness of Her Majesty's Government. There are several improvements, or suggestions for its improvement, which I should have been glad to have made, had time and opportunity been granted me, while the invention was still under trial.

But if I regret that after two years' work and study of the subject, my connection with it now ceases, at perhaps the most critical and interesting time, it is without the selfish complaint of *sic vos non vobis* that I leave it, but honestly desirous of seeing that which I believe likely to prove of advantage to my country perfected and adopted, to whomsoever may eventually belong the credit of its introduction.

SUGGESTIONS FOR THE LAND TRANSPORT SERVICE OF THE ARMY.

By **George G. Beazley**, Captain 83rd Regiment.

> "A veteran army indeed, kept constantly ready for marching is expensive, yet it gives a State the disposal of things among its neighbours, or at least procures it a great reputation in other respects."
>
> "It was a just answer of Solon to Crœsus, who showed him all his treasure: 'Yes, sir, but if another should come with better iron than you, he would be master of all this gold.'"
>
> Lord Bacon.

So many schemes connected with the management of the Army have lately been proposed and discussed, that it would seem almost needless to bring forward another. They have, however, chiefly referred to the subject of recruiting. This has been pretty well exhausted. Most persons who have attentively considered the matter have probably arrived at the conclusion that we can only compete with the armaments of the Continent by the introduction of a modified conscription, and the gradual abolition of the militia, yeomanry, and volunteers for a really effective Reserve, composed of men who have served a few years in the regular Army.

The object of the present paper is not to treat of recruiting, but to deal with the equally important subject of transport, touching incidentally on the defence of this country—vital questions, on whatever system men may be raised for military service. The British Army, though in many respects well organized, stops short of completion. We have regiments perfectly drilled and equipped; yet beyond their clothes, arms, and accoutrements, they have little that they require in the field. To move them entails numerous returns and much correspondence. To collect and place even a small force in the field to meet the enemy would, as there is little or nothing ready in the way of transport, be a matter of some difficulty. To obviate this defect, and remove the attendant delay and uncertainty, is the aim of the following plan.

Any proposal connected with the organization of an Army divides itself into two distinct branches, namely, the organization required for war, and that required for peace.

Although the former is the really important branch, yet peace being the normal condition of armies, it is impossible to devise a plan for the one without considering the other. The question then is, how to be prepared for war at a moment's notice, without unnecessarily depriving Officers and men, during peace, of the ordinary advantages and comforts enjoyed by the citizen.

The outline plan which follows, applies chiefly to the Infantry; but, with certain self-evident modifications, includes the other arms of the Service, and is intended, in a great measure, as the basis of a scheme to ensure this country against surprise by invasion.

Since the regimental system of the British Army has been pronounced perfect as far as it goes, and since it is the system the most suitable to our wants, why not, instead of engrafting upon it modifications of Continental plans, endeavour to render it complete?

The Unit.—It is therefore proposed that the regiment should be made the unit of efficiency. That all transport, certainly of the first reserve of stores, and second of ammunition, should be organized upon a system based on the requirements of a regiment, and not on the wants of a brigade or larger unfixed unit.

To carry out the above idea, a regiment must be a fixed, distinct, and independent body, self-reliant for (1) transport, (2) food, (3) shelter, (4) clothing, (5) regimental and first reserve of ammunition, and (6) hospital.

Regimental Train.—The first thing to be provided is transport. In this country waggons are the most suitable. These waggons should be so constructed that without unloading they could travel on the railway trucks. As they would be in charge of the regiment, they should be marked with its number, the letter of the company or companies, or name of the department to which they belong. On the march they would follow the regiment, brigade, or division, in charge of men of the regiment, who should walk or drive, but not ride.

The *minimum* amount of tentage, baggage of Officers, tools and implements, arm chests, squad bags, reserve ammunition and *impedimenta*, including regimental hospital equipment, *absolutely required in the field*, would have to be fixed as to size, shape, and weight. These points being settled, the number of waggons to be allotted to each regiment would be determined.

In time of peace, contractors would supply the horses and harness at fixed rates, and possibly the same arrangement might be the most economical in time of war. Cast artillery, and cavalry horses, which sell for little or nothing, might be made available, if it were considered desirable to maintain the nucleus of an independent system; one or two horses to a regiment, for instance. Oxen should not be overlooked; they cost less, require little harness, move fast enough, are easily conveyed by railway, and when old, or in case of emergency, could be eaten. How far the employment of traction-engines could be used with advantage might be worthy of experiment.

It has been urged that waggons would not be required in England, as the railroads would furnish all the necessary conveyance. Though railroads would greatly facilitate the movements and concentration of troops, it is clear that were the line, bridges, or viaducts destroyed, or the post to be occupied only a short distance from the station, it would be absolutely necessary to have the baggage brought up. For real efficiency, therefore, it may be assumed that the waggons could not be dispensed with.

To diminish the baggage now carried about by Officers, barrack-rooms should be furnished with all the articles required beyond the ordinary field kit.

All private baggage in time of peace should be moved independently of the regiment, by private carriers, as at present.

Food.—Instead of butchers and bakers being formed into one corps under a civil department, each regiment should have its own, liable to do military duty when not required in the exercise of their trades. These men would work in regimental, brigade, or divisional abattoirs and bakeries, receiving while so employed substantial working pay. In the event of misconduct, or the departure of a corps, all men so engaged away from their regiments, would rejoin.

Regimental Clothing.—A moderate supply of the most essential articles (such as boots, gaiters, socks, and flannel shirts) should accompany the regiment, a minimum being fixed for field service. These would have to be replenished as opportunities offered. The bulk of the Quartermaster's stores, would, in time of peace, have to move with the private baggage, or be left in charge of the depôt on the regiment going under canvas.

Regimental Ammunition.—The regimental reserve of ammunition (30 rounds per man), which might with advantage be considerably increased, should be divided among, and carried with the company's baggage, unless the regulation-means were provided.

The first reserve of small-arm-ammunition, now carried by the Royal Artillery, should be in a separate waggon, containing the necessary means for distributing it in difficult ground.

Regimental Hospital.—Medical Officers should be formed into one corps, and one, two, or three, according to the exigencies of the Service, attached to a regiment. The hospital should be entirely regimental, and all drugs, instruments, stores, and comforts should be drawn direct from the medical stores by the Surgeon doing duty with the regiment.

Though the Surgeon would not belong to the regiment, or adopt its uniform, he would be under the orders of the Commanding Officer, and in every way responsible for the thorough efficiency of his own department.

General Hospital.—Wounded men, and men too sick to travel, would, as now, be left in General Hospitals, established in garrison towns, or at the different depôts on the lines of communication. Only the Regimental Hospital, with the simplest cases, should move with the troops.

The Army Hospital Corps should be disbanded, their duties being always performed in regimental hospitals by trained soldiers of the regiment; in General Hospitals in garrison towns (during peace) by similar men from the several corps serving therein; in war time, by civilians, men or women, supplemented by disabled and convalescent soldiers.

In order to obviate any inconvenience which might arise from sickness, misconduct, or furlough, every regiment should have a considerable number of men trained as drivers, butchers, bakers, and hospital orderlies. The last, as well as all bandsmen, should be trained at Netley, and be thoroughly instructed in ambulance duties. All such men, when thus employed, should receive a moderate daily sum, in addition to their pay.

So much for the regimental arrangements. Should such a scheme, or a modification of it, ever be adopted, it is evident that the responsibility of Officers commanding regiments and companies would be materially increased. Every Officer commanding a regiment would be bound to keep it fully equipped, and up to the regulation standard of efficiency. For this purpose he should communicate *directly* with all the departments of supply in all matters not involving maintenance, exchange, or expenditure beyond the recognized equipment.

Supply Departments.—The Supply Departments are the Commissariat, the Store, the Paymasters, the Barrack, the Purveyors, and the Medical.

In view of the proposed plan, the union of the first four departments under what is termed the "Control System" would not be desirable; they should be kept separate. Their duties are perfectly distinct; they have nothing in common. A Controller is only acquainted with the department to which he originally belonged; consequently, when referred to on a subject out of that sphere, he would be obliged to forward the correspondence to the branch of the control concerned. Thus, in most cases, the control system would only add another channel of communication to those already in existence. The only real control required would be that exercised by the War Office on the part of the Treasury. The Officers of the supply departments, therefore, while under the authority of the senior combatant Officer for the correct discharge of their duties generally, should—both for the benefit of the public purse and their own support and security—be accountable to the War Office for their expenditure. To prevent unnecessary reference, a clear code of regulations should be drawn up for the guidance of each department, and the Army generally. Such rules would, however, be liable to be set aside by General or other Officers commanding independent bodies of troops during war.

Paymaster's or Accountant's Department.—The Paymaster's Department, representing, and communicating directly with the War Office, would have sole charge of the financial arrangements and the military chest. From it, as from a bank, all money required by Regimental Paymasters, or departments, should be drawn.

The Purveyor's Department.—The Purveyor's Department should be abolished, and the duties of these officers, as far as the care and distribution of medicines and comforts are concerned, be entrusted to medical officers of different grades, on additional or Staff pay. This would tend to the unity of the Medical Department.

The Barrack Department.—However opinions may differ as to the advisability of bringing several distinct departments under one head, there can be little doubt that, for such a scheme as the present, the

Barrack Department should be retained as a separate branch of the Service. Although barracks might, and indeed would be, frequently occupied in time of war by the regulars or reserves, they are, nevertheless, the natural home of the soldier during peace. Here the recreation-rooms, libraries, schools, workshops, and canteens are established. These cannot, even in a modified form, accompany the troops on active service; they, with the barracks, are stationary, and are pre-eminently adapted only to peaceful times. The Commissariat, Store, Medical, and Paymaster's Departments, on the other hand, must be with the troops, whether in barracks or in the field. This distinction seems to point clearly to the necessity of maintaining the integrity of the Barrack Department as a separate establishment. This principle admitted, it would be desirable that the Barrack-masters should be selected from Engineer or other Officers, who having a taste and aptitude for construction, might be willing, for the sake of a fixed home, to relinquish their military career—retaining, however, if they wished it, honorary rank.

They should have charge of all permanent military buildings and property, including hospitals, libraries, schools, books, recreation-rooms, canteens, furniture, *and all implements not required in the field.* The construction of new barracks, all additions to, improvements and repairs of old, should be carried out by them, either by contract or military labour.

Thus the Officer of Engineers would be relieved of all duties connected with the construction and repair of barracks, and be enabled to keep up the special knowledge required of him on service.

There should be a store in every barrack for the private baggage of Officers, and the surplus of Officers' and Serjeants' messes; so that when the regiment encamped for the periodical summer drill, the rooms might be handed over to the Barrack-master either for repairs or for the occupation of another regiment.

Departmental Trains.—The Regimental Trains having been provided for, we now come to the consideration of the transport required by the different departments attached to the Army. This should be divided into the following branches:—

1. The Store Train, including (*a*) Artillery reserve stores and ammunition; (*b*) second reserve of small-arm ammunition; (*c*) saddlery and harness; (*d*) spare tents; (*e*) spare carriages for all arms.

2. The Clothing Train (this might, perhaps, form part of the Store Train), with similar supplies to the Regimental Train.

3. The Engineer Reserve Train.

4. The Paymaster's Train.

5. The Medical Train, with all the medicines and appliances required to replenish regimental consumption and losses, and to establish temporary general hospitals in the event of an engagement.

6. The Commissariat Train.

The Trains above detailed (1 to 5) should always be kept up, and the waggons be more or less ready packed, on a plan based upon the wants of a regiment or battery. This portion of the train—which for the sake of distinction we will call No. 1—should be that which would move with the column to which it might be attached. The train to supply it with stores and ammunition, as expended, should consist, as must ever be the case, of the civilian transport available at the theatre of war, such as railways, carts, mules, or water carriage. No great difficulty could be experienced in fixing upon the amount of carriage required for No. 1 train, so as to enable a force to fight one or two battles without replenishing.

Commissariat Train.—To estimate the transport required by the Commissariat Department is a more difficult problem. The daily necessity of supplying food and fuel, and that bulky requisite, forage, and their collection from the neighbourhood, or transport from the depôts in the rear to the point of issue, depending on inconstant data and varying circumstances, render even an approximate calculation uncertain. It may, therefore, be assumed that even No. 1 Commissariat Train would, on war breaking out, be supplemented more or less by contractors' and vendors' carts.

The Regimental Trains could always, when the men were encamped and their waggons consequently empty, convey their supplies from the Commissariat point of issue to the respective camps. If necessary, a special or spare waggon might be used for that purpose. In brigade, regiments should furnish one waggon or more daily, in turn, for the use of the whole brigade.

Paymaster's Department Train.—The strength of the Paymaster's train would vary with the nature of the money in circulation. Even if the latter consisted principally of gold or notes, a considerable sum would have to be in small coin, to meet the wants of the soldiers. In the United Kingdom this train might, from the facilities of obtaining money, be dispensed with, provision, of course, being made for the office books.

All these departments—essential as they are for the efficiency, and even the existence of the Army—require men of business, and not military men, to ensure the objects for which they are created. They should, therefore, be strictly civil in their nature. And here another difficulty presents itself—Who is to have the control and authority over the different trains? This is a question not easily answered, for if the men composing them were soldiers, how would military discipline and order be maintained?

That each department—especially the Commissariat—ought to have control over the whole of its own duties, both in collecting and delivering its supplies, cannot be doubted. If its Officers were to have the whole responsibility they would be more independent, more punctual, and efficient; they could time and arrange their measures so as best to meet the varying difficulties they would constantly have to encounter; and while much correspondence would be saved, the issue of food and forage would be far more satisfactory in the long run, than if the duty of delivery were performed by a separate branch of the Service. These remarks apply in a less degree to the other departments.

Assuming that the horses, or oxen, waggons, and harness (the latter of the plainest pattern), would be in the charge of the different departments, it only remains to provide the drivers.

Drivers.—To meet this difficulty there would appear only one or two ways. One would be to have a corps of drivers, under Officers and Non-commissioned Officers, subject to the Articles of War, but non-combatant. These men should drive, or walk, but not ride; they should be dressed in a simple working suit; be bound to help load or unload; and make themselves generally useful. In time of war they should be armed with a revolver only. Though they would be quite distinct from the Army, discipline should be maintained on the Army system. The detachment of these men required by a department for No. 1 train, would be under an Officer or Non-Commissioned Officer, according to its strength; the Officers, Non-commissioned Officers, and men, while so employed, being bound to obey the head of the department to which they were attached. In fact, the corps should be a body of useful, willing, working men, not above their work, with nothing whatever of the Dragoon about them—as unlike the present Military Train as light is to darkness. To compensate the Officers and men for their anomalous position in a military point of view, it would be necessary to pay them well. They should only be taught to drive, park, and pack their waggons—no drill or instruction beyond this would be necessary. The Officers, of whom there need be few, should be mounted. Non-commissioned Officers should drive, walk, or have a seat on the rear waggon, or, when there were more than one, on the front and rear waggons of the portion of the train in their charge. Such a corps should not consist of volunteers from other regiments, as they would at once bring into it the military element, which from its very nature and duties would be objectionable. A few sensible Non-commissioned Officers (who should be made thoroughly to understand that they would, on joining the corps, have to relinquish much of their "smartness"), might be necessary at first, to establish the interior economy of the barrack-room. Such a body in time of peace would probably be only a skeleton corps, but, the duties being simple, no difficulty would be found in augmenting it on very short notice, as the trained men would soon instruct the recruits. Men might be enlisted for such a corps for short periods, the pay being a sufficient inducement.

The other plan would be to have a similar corps under the command of the Officers, clerks, and issuers of the Supply Departments. These men, being simply drivers, would be interchangeable among the departments, according to the requirements of the different trains. Their distribution would be determined by the Transport-Director and Quartermaster-General's department. If, however, it should be considered advisable to keep the supply departments distinct, and complete in every respect, then each corps should have its own body of drivers. If the extra work thus entailed were not an insuperable objection, either of the plans, but especially the last, would probably prove the most efficient in practice, as each department, being complete and independent, all collision of authority would be avoided. It would also assimilate with the regimental system already proposed.

Transport Directors.—We have now provided for the regimental and departmental trains. To avoid confusion on the line of march, it would be necessary to place them in charge of an executive Officer. With a large train, Brigade, Divisional, and Corps Transport-Directors would be required. The senior of these Officers with the force, would receive his orders direct from the Quartermaster-General's Department. Being invested with supreme authority during the march, he would be responsible for the correct movement of the whole. Officers so employed would require considerable tact and ability to deal efficiently with rival interests; and, while enforcing strictly the rules and customs necessary to secure the uninterrupted movement of the trains, ought to have the power as well as the judgment to know when to relax them. If a special and separate corps of drivers were established, the above duties would devolve on the Officers of that corps. The Transport-Directors should alone have the power to halt or move the line of waggons; the Officers commanding the escorts having nothing to do beyond defending them in case of attack.

No. 2 Train.—The train communicating with No. 1 and the base should be organized on a similar plan, but, with the exception of the Transport-Directors, should consist of civilians hired for the time being. It is not much more difficult to bring up stores and supplies for an Army than for a large city, as long as the communications are not threatened or attacked.

In the United Kingdom and in many other countries, the second train would be furnished by the railways; the regimental and No. 1 trains would be able to bring the supplies up to the front from the depôts established at the railway stations.

Summary.—We thus have a transport system, where the regimental trains, driven by soldiers only, would be employed with the troops in the presence of the enemy, or where military discipline is most required; behind them would come the departmental trains, and their disciplined non-combatant drivers, while in the rear of all, and out of danger, would be No. 2 train, manned by civilians.

Each train while in camp would be comparatively independent, and at the disposal of the regiment or department to which it belonged. On the line of march all would be under the Transport-Directors. Thus would be combined the advantages in camp, which a certain amount of freedom would give, with the order and discipline on the line of march absolutely requisite to ensure the unbroken progression of the whole.

Districts.—Reverting to the defence of this country it would be necessary to re-divide the whole kingdom with reference to the railway system, into military districts, to be placed under General Officers, who should command the whole of the troops, both regular and reserve. The head-quarters and a fortified magazine should be at or near the chief railway station, or at an important junction, connected, if necessary, by a branch with the main line. At this secure point all the transport and stores for No. 1 Train of the regular troops, and the stores for the reserves of the district, should be accumulated, as well as a sufficient supply of all equipment, to make good regimental losses, breakages, and expenditure.

About eight or ten districts in Great Britain, and four in Ireland, would probably suffice. These being in direct communication with the Government arsenals, would be easily kept supplied with all the stores required. The districts should be so arranged that each should include a portion of the sea-board. Suppose, for example, that England were divided by radial lines, following the boundaries of counties, drawn from a point near Tamworth to the coast; or, for simplicity's sake, into four, by two lines, one from Hawick in the north to Southampton in the south, the other from Milford Haven to Holbeach. The respective head-quarters might be established at or near Chester, York, London, and Gloucester. This, though only intended as an illustration, would give each a portion of the sea-board to guard.

Provision has now been made for the active Army, or *first line*.

1st *Reserve.*—The *second line*, or first reserve, should be organized on a similar plan, substituting the agricultural carriage available. All such carriage should be apportioned (a law being enacted for this purpose), to the different Reserve regiments, so that each Commanding Officer should know to what farmer or job-master he would have to go for his transport. His stores he would obtain from the district magazine. Some delay would doubtless occur before the first Reserve would be ready to move, but in the mean time the active Army would be on the march fully equipped, giving the first Reserve ample time to prepare for the field.

2nd Reserve.—A similar scheme would hold good for the second Reserve. The remaining Reserve troops would be employed in holding the fortresses and towns.

Camps.—In the drill-season, regiments, both Regular and Reserve, should assemble at the different camps, and remain under canvas, during the periods allotted to brigade and divisional instruction. The present huts should, as they decay, be removed, and not replaced.

The regular regiments being in possession of transport, should assist the regiments of the Reserve in bringing their camp equipage to and from the railway stations; as it would not be desirable to call upon the agricultural carriage, except in case of danger from invasion. Failing this, one or two permanent buildings might be constructed at the camps, to hold sufficient camp-equipage to meet the usual summer demands of the Reserve forces.

In order to reduce expenditure, regiments, as a rule, should remain a year in their quarters, and only move out for their summer drills. The annual hire of horses for the regimental trains would not amount to much, provided the moves now so frequent, were limited to the above periods.

Whether it would be advantageous to extend the system proposed for the regiment, by forming a regimental unit, say of a wing, two companies, or even one, would depend upon the number of waggons a regiment would require, and the distribution of the equipment.

The more effectually to carry out the above plans, Commanding Officers of regiments should be relieved of a good deal of their present office work. The returns now rendered should be revised. All returns and accounts of schools, canteens, and recreation-rooms, might stop at the regiment being, if necessary, periodically examined, either at the half-yearly inspection, or by some Officer or Department appointed to supervise the whole of these and analogous institutions.

Departmental Subordinates.—A certain number of men of superior attainments would be required as compounders, issuers, and storemen, for the medical and other departments. Such men should be subordinate to, and as a rule under the sole authority of the Officers of these departments. There would be no occasion to enlist them, simply because they would administer to the wants of the Army. They might be engaged on terms calculated to meet all that could be required of them in their civil capacities, and yet to secure a due amount of subordination to military authority.

Indeed it would appear advisable to organize the whole of the subordinates of the Civil Departments on a system adapted to their special duties, rather than on a military basis; the Officers of the respective departments being responsible for their efficiency, and for the maintenance of such discipline as might be expected and required. There is nothing military in providing food, clothing, pay, arms, and ammunition for an Army. Even in the treatment of a soldier either for disease or wounds, medical, not military science is required. All such men should therefore have no arms, except during war, when, in order to meet unforeseen dangers, they should be supplied with a revolver apiece. As such emergencies occur so seldom during a man's lifetime, they should not be trained as soldiers, beyond being taught the use of their weapon. It is not worth while to combine in one man two incongruous duties, one which he has to exercise daily, with another which he may never be called upon to perform.

Advantages of Proposed Scheme.—Such a scheme fully carried out would entail considerable expense at the outset, but it would ensure proportionate advantages and security.

If, however, the magazines were not fortified, or if their defences consisted simply of earthworks, thrown up by the troops, the outlay would be almost limited to the cost of the waggons.

The Store Department would be relieved of the main portion of their present charge, and their duties would be appreciably diminished, especially at the most critical moment, namely, the first alarm.

Every regiment would at all times be prepared, without a moment's hesitation, to march out of barracks, ready in every respect for a campaign. The depôt, school, women and children would remain behind. All the private baggage (materially diminished by the furnishing of barrack-rooms) and *impedimenta* not required in the field, would be stowed away in one of the spare store-rooms.

On any emergency, a brigade could be told off from a division, a division from a corps, a corps from an army. Particular regiments might be selected if needful. With the exception of the Commissariat, —and they should be fairly ready,—the Supply Departments would at once furnish No. 1 train, simply on being informed of the number of Batteries, Companies of Engineers, Regiments of Cavalry and Infantry composing the force. The waggons would, if the point of assembly were distant and approachable by railway, be run on to the railway trucks, starting at once for their destination, or awaiting the order to move. Draft animals would either accompany them, or be directed to meet them on their arrival at the given point. Here the advantage of having the waggons packed according to the wants of the *unit* will be at once apparent.

It would ensure the greatest elasticity, by facilitating the increasing, reducing, or detaching a force, since the order alone would furnish sufficient information for the Officers commanding regiments, and the heads of departments, without further reference or directions.

It would give great independence in the event of regiments or brigades being cantoned in separate villages, as then the butchers and bakers could act for their own regiments, or, combined, for the brigade.

The troops in each district would be at once able to present a front, and oppose any landing on their sea-board.

Regiments could embark without delay for foreign service. If to take the field, their waggons and draft animals depending on the scene of operations, would or would not, accompany them. If for an ordinary tour of foreign service, the waggons and animals might be left behind, and their places supplied on disembarking by a similar set, or by a set adapted to the new station. If, however, mules were the only available means of transport—though the same organization could be retained—the great increase in the number of animals would necessitate the employment of a certain number of natives, even with the regimental trains.

It would facilitate the instruction of the troops, by enabling them to encamp during the summer drill, free of all encumbrances, precisely as they would be in active service.

The sum now annually expended in the maintenance of the wooden huts in the respective camps would be saved, and a portion of it would cover all the expenses for the hire of draft animals during the drill season.

The regiments would have the advantage of spending a great portion of the year in towns, instead of in the wooden huts, isolated from the public.

After the harvest, brigades, or divisions of the active Army, could manœuvre over extended areas, encamping in the fields, thus realising and practising the strategical operations incidental to real war.

The division of labour and supervision, obtained by the separation of the regimental and departmental trains, would give to each that individual interest which always tends to real efficiency, and would more than compensate, in practice, for any advantages which might be gained by the centralization of the whole transport in a single department.

The men of the departments being relieved of all parades, care of arms and accoutrements, their whole time would be usefully employed in their special duties. In short, fewer men would be required, and the revolver would meet all that could be required of these as armed men in time of war.

Were the scheme confined to regiments, a most important establishment would be at once created, as with such a train, without *an extra Officer or man*, an Army, especially in the United Kingdom, could, on the first outbreak of hostilities, shift for a considerable period, if not altogether.

If the departments were unprovided with waggons, the stores, materials, and implements might still be arranged in the magazines, according to the wants of a regiment, ready to pack on any carriage available.

Conclusion.—In conclusion, though the plan I have ventured to propose may be crude, present many difficulties, have many defects in detail, and be open to criticism, it is submitted that, while in the main simple and practical, it fulfils the conditions set forth in the beginning, namely, those of securing the advantages of constant preparation for war, with all the benefits pertaining to peace.

PROCEEDINGS

AT A

SPECIAL GENERAL MEETING.

A Special General Meeting was held in the Theatre of the Institution, on Monday, July 5th, 1869, at 4 P.M., to consider the following proposed additions to the Bye-laws relating to Subscriptions, viz.:—

> "That all Members joining the Institution on or after January 1st, 1870, shall be entitled to receive the Journal from the date of their becoming Members.
>
> "They shall pay an Entrance Fee of £1, and an Annual Subscription of £1, whether they are at Home or Abroad; or they may become Life Members by a payment of £9 in addition to the Entrance Fee."

General Lord Hotham, President of the Institution, in the Chair.

I. The Secretary read the Notice convening the Meeting.

II. Rear-Admiral Sir Frederick Nicolson, Bart.:—

Gentlemen,—the proposition which I have now to bring forward is one that comes before you with the authority of the Council. The object which I had in view in bringing the proposition originally before the Council was this:—It occurred to me that it would greatly simplify our accounts to make the subscriptions uniform, as at present we have two different classes of subscription. Again, the alteration would place the *Journal* in the hands of all the Members, instead of only in those of a certain number. I think the more our *Journal* is distributed, the more people will be made aware of the objects of the Institution; and the greater the advantages it will afford to the Members of the Two Services. I think the only argument against the proposition is this, Will it diminish the number of entries in future, will it keep away those who might become Members? If the Meeting will allow me to read a few figures, they will see that there is very little foundation for any fears on that head. The numbers who joined in 1866 were 126 Members at a pound, and 16 at ten shillings; in 1867, they were 97 at a pound, and 17 at ten shillings; in 1868, they were 136 at a pound, and only 28 at ten shillings; and from the returns up to the present time, I find that out of 111 who have joined the Institution since the beginning of the year, only 5 are Members at ten shillings, and only 1, a Life

Member at the lower rate of composition, that is, at £6. So I do not think we need have the least fear that if this rule be carried, we shall lose any number of Members. I hope it is understood by all present that the proposed step is not *retrospective;* it simply applies to Members who shall join on or after the 1st of January, 1870; therefore it will not affect any Members who already belong to the Institution. With regard to the proposal that Members abroad should pay the same amount as Members at home, I may likewise mention that this will affect but a very small number. Our present rule is this, that any Member who pays one pound a-year at home is entitled to the *Journal;* and if he goes abroad on service he is allowed to reduce his subscriptions to ten shillings a-year, and still to receive the *Journal,* on giving notice of his wish to that effect to the Secretary. I find from the returns in the office, that the number of Members who have reduced their subscriptions from one pound to ten shillings, on going abroad, is only 15 in three years; an average of 5 Members a-year who have reduced their subscriptions. I am really not aware that it is necessary to detain the Meeting any longer upon this point. Members who have looked minutely into the accounts must know the complication that is caused by having so many different rates of subscription. In due course of time, as the old Members die out, and we get fresh Members to replace them, as I hope we shall do in equal numbers, this proposal will increase our revenue by somewhere about £500 a-year. At present the number of Members paying ten shillings a-year, is about 1,100. I feel confident that young men joining the Institution will not hesitate to pay one pound; they will willingly pay the pound remembering that for that one pound they will get the *Journal.* I will now move the resolution, but before doing so, I may add that I propose that the new paragraph should be inserted after paragraph 7, Section IV. of the Bye-laws. I do not propose that any alteration be made in the existing laws, because those laws still apply to those already Members. The simplest way, therefore, will be to insert this as an additional paragraph after paragraph 7. It will read as follows:—

"All Members joining the Institution on or after January 1st, 1870, shall be entitled to receive the *Journal* from the date of their becoming Members.

"They shall pay an entrance-fee of £1, and an annual subscription of £1, whether they are at home or abroad; or they may become Life Members by a payment of £9 in addition to the entrance-fee."

General Sir William Codrington, G.C.B.:—

I beg to second the resolution which has been proposed by Sir Frederick Nicolson. It has received the consideration of the Council, and is now brought forward by their direction. Of course, it is for this Meeting, convened as a Special General Meeting for the purpose, to decide the question. The *Journal* being an expensive as well as a very valuable publication, I do not think there are any Officers who would really wish to reduce their subscriptions to Ten Shillings and yet receive it free, when the additional Ten Shillings would be of such an advantage to the Institution. I really do not think there is any more to be said on the subject, and it only remains to submit the proposal to this Meeting for their approval and confirmation.

Major-General Boileau, F.R.S.:—

I have great pleasure in supporting this resolution, because I go heartily and entirely with the mover and seconder of it. The subject was brought before the Council several times during the period I had the honour of sitting at the Board, and it always received my concurrence. I believe, indeed, on one occasion, I myself brought forward a proposition that the subscription should be increased to £1. It appears to me that the question is entirely one-sided, that there is nothing to be said against it, and everything to be said in its favour. First of all, it will equalize the subscriptions, which will be a very desirable change; secondly, I consider that every Member of the Institution ought to have the privilege of paying the same sum, and of receiving a copy of the *Journal.* The *Journal* is very expensive, and I have never considered it a favourable arrangement for the Institution, that a man subscribing ten shillings and going abroad, should have the privilege of taking the *Journal;* or, subscribing ten shillings at home, he should not be privileged to receive it. I think we ought to make everything equal in an Institution of this kind: first of all that the subscriptions should be equal, which would very much simplify the Accounts; and, secondly, that every Member should participate in the entire advantages of the Institution. On those two grounds, I beg to say that everything that has been proposed has my concurrence. I might say one word with regard to the payment of Life Subscriptions. The sum of £9 seems to me, calculated as it should be upon the duration of life, to be a sum very much less than Members securing a life-interest in the Institution ought to pay. But it has been for some years the rule, and is still the rule. I will not make any objection or propose any amendment upon that point. But I do submit, with all deference, for the consideration of the Council, as an actuary, that this sum of £9 is very much less than persons entering the Institution, especially those who are young in the Service, ought to be required to pay. The probable duration of life of a man entering the Army is from twenty to thirty years, so that there is a loss of £20 upon a £9 payment, which does not bear compound interest, because these sums are funded and the interest is applied to the current expenses of the Institution. Therefore, in giving my hearty concurrence to the proposal, I would respectfully ask the Council to take the question of Life Subscriptions into their consideration at some future time.

The CHAIRMAN having put the Resolution, it was carried.

A discussion subsequently arose on the following points raised by Captain Tyler, viz., to insert at the end of par. 7 the words, "the above rules shall apply to all Members joining before the 31st December, 1869:" and secondly, that pars. 3 and 4 should be altered so as not to conflict with the rule just passed. After considerable discussion, at the suggestion of the Chairman, it was decided that the resolution as originally moved should stand, and that if between the period when the new rule would come into operation and that of the next Annual General Meeting, any inconvenience should be found to result, or if it were found desirable to make into one the several paragraphs relating to subscriptions, the question should then be brought forward and dealt with.

The CHAIRMAN then announced that the business of the Meeting was concluded.

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The Journal

OF THE

Royal United Service Institution.

VOL. XIII. 1870. APPENDIX.

PROCEEDINGS OF THE THIRTY-NINTH ANNIVERSARY MEETING.

THE THIRTY-NINTH ANNIVERSARY MEETING of the Members was held in the Theatre of the Institution, on Saturday, the 5th March, 1870.

The Right Hon. EDWARD CARDWELL, M.P., Secretary of State for War, in the Chair.

I. The Secretary read the Notice convening the Meeting.

II. The Minutes of the Thirty-eighth Anniversary Meeting were read.

III. The Annual Report of the Council was read as follows:

1. THE COUNCIL have the pleasure of submitting the Thirty-ninth Annual Report.

MEMBERS.

2. During the year 1869, one hundred and sixty five Members joined the Institution. The Council regret to record the loss by death of ninety-eight and by withdrawal of fifty-nine. The names of twenty-eight have been struck off the lists, their subscriptions having been unpaid for two years and upwards. The loss on the year therefore amounted to twenty.

A detailed statement of the changes in the list of Members, and a tabular analysis of the past and present state of the Institution, will be found on pages 11 and 12.

FINANCE.

3. The usual Abstract of the Yearly Accounts, as audited on the 3rd February, will be found on the following page:—

GENERAL ABSTRACT OF THE ACCOUNTS OF THE ROYAL UNITED SERVICE INSTITUTION, FROM 1st JANUARY to 31st DECEMBER, 1869.

EXPENDITURE.

	£ s. d.	£ s. d.
Secretary's Salary		250 0 0
Ditto Lodging Allowance		50 0 0
Librarian's Salary		104 3 4
Accountant's ditto...		100 0 0
Clerk's ditto		62 0 0
Servants' Wages		378 12 9
Ditto Clothing...		46 9 6
Insurance...		20 5 0
Ground Rent		200 15 10
Fuel		57 7 6
Lighting		43 4 10
Annuity to John Pitt		20 0 0
Assessed Taxes		48 3 5
Income Tax		5 0 0
Parish and Water Rates		110 12 6
Artificers		167 14 8
Museum		84 10 9
Library		245 8 6
Topographical Room		1 15 0
Advertisements		46 10 6
Printing Circulars and Stationery		94 13 5
Lectures		32 14 0
Journals, including Annual Report and List of Members		879 0 5
Postage { Journals	163 13 9	
Postage { Letters	45 10 10	
		209 4 7
Loan of Exchequer Bills		5 9 0
Expenses consequent on the Coin Robbery		119 8 11
Miscellaneous		41 14 7
Balance of Petty Cash returned to Bankers		18 5 7
Total Expenditure		£3,448 4 7
Cash repaid to Agents		9 12 3
Charges from ditto		0 11 6
Invested in purchase of £257 9s. Consols		237 0 0
Interest paid on purchase of £1,000 Exchequer Bills		3 15 4
Balance at Bankers, 31st December, 1869 { Income ...	227 10 0	
Balance at Bankers, 31st December, 1869 { Life ...	18 0 0	
		245 10 0
Total		£3,940 3 8

Examined and found correct.
3rd February, 1870.

{ H. F. DOWNES.
{ J. E. A. DOLBY.

RECEIPTS.

	£ s. d.	£ s. d.
Balance at Bankers, 31st December, 1868		180 19 10
Annual Subscriptions, at 10s., for 1869	474 1 0	
,, ,, above	1,873 13 0	
,, ,, arrears	15 10 0	
,, ,, advance	5 10 0	
		2,368 14 0
Entrance Fees		165 0 0
Donations		3 0 0
Dividends		207 6 10
6 months' Interest on £1,000 Exchequer Bills		12 3 9
Sale of Journals		109 15 4
,, Waterloo Pamphlets		0 18 0
,, Waste Paper		12 12 0
Interest on £1,000 Exchequer Bills sold		5 18 4
Government Grant		600 0 0
Balance of Petty Cash returned to Bankers		18 5 7
		£3,684 13 8
Balance of Life Subscriptions at Bankers, 31st December, 1868 ...		17 0 0
Life Subscriptions, received during 1869		238 10 0
Total		£3,940 3 8

GEO: FELSTEAD, Accountant.

ESTIMATE OF RECEIPTS AND EXPENDITURE FOR THE YEAR 1870.

EXPENDITURE.	£	*s.*	*d.*
Secretary's Salary and Lodging allowance	300	0	0
Librarian's Salary	100	0	0
Accountant's „	100	0	0
Clerk's „	62	0	0
Servants' Wages	400	0	0
Ditto Clothing	50	0	0
Insurance	11	5	0
Fuel	60	0	0
Lighting	45	0	0
Ground Rent	205	0	0
Annuity to John Pitt	20	0	0
Assessed Taxes & Income Tax	145	0	0
Parish and Water Rates	110	0	0
Artificers, Repairs, &c.	150	0	0
Library and Topographical Department	170	0	0
Journals	850	0	0
Postage thereof	160	0	0
Museum	200	0	0
Advertisements	50	0	0
Lectures	40	0	0
Printing Annual Report and List of Members	80	0	0
Printing Circulars, & Stationery	90	0	0
Postage	60	0	0
Sundries	50	0	0
Balance	139	5	0
Total	£3,647	10	0

RECEIPTS.	£	*s.*	*d.*	£	*s.*	*d.*
Balance at Bankers, 31st Dec., 1869				227	10	0
Annual Subscriptions:						
At 10*s.*	450	0	0			
Above	1,900	0	0			
				2,350	0	0
Entrance Fees				150	0	0
Dividends				230	0	0
Sale of Journals				90	0	0
Government Grant				600	0	0
Total				£3,647	10	0

LIFE SUBSCRIPTIONS.

4. Life Subscriptions amounting to £237 10*s.*, including £17 not invested last year, have been invested in Three per Cent. Consols. A balance of £18 remains for future investment.

CAPITAL ACCOUNT.

5. The funded property of the Institution, on the 1st January, 1870, was £6,653 17*s.* 8*d.*, as compared with £6,396 8*s.* 8*d.* on the 1st January, 1869.

ALTERATION IN THE BYE LAWS RELATING TO SUBSCRIPTIONS.

6. At a Special General Meeting of the Members held in the Theatre of the Institution, on Monday, the 5th July, the following resolution was passed, viz., "That all Members joining the Institution on and after the 1st January, 1870, shall be entitled to receive the Journal from the date of their becoming Members. They shall pay an Entrance Fee of £1, and an Annual Subscription of £1, whether they are at home or abroad, or they may become Life Members by a payment of £9 in addition to the Entrance Fee."

LEASE OF THE PREMISES.

7. The Council regret that they are still unable to give the Members any definite information with respect to the tenure of these premises.

They do not however, anticipate that any change will take place during the present year.

LECTURES AND JOURNAL.

8. The Lectures and Discussions of the past year cover a wide field of Naval and Military subjects. The sale of the Journal, which was greater last year than at any previous period, is the best proof that it maintains its high reputation. The Council tender their thanks to those gentlemen who have contributed so much valuable professional information.

LIBRARY.

9. Five hundred and sixty volumes were added to the Library during the past year. Of these 225 were purchased, and 335 presented. Among the latter, the following are the most prominent:—

By the AUSTRIAN Government—
  The 4th and 5th volumes of *The War of* 1866.
By the ITALIAN Minister-at-War—
  The *Annuario Militare*, 1869.
  " *Giornale Militare*, 1868.
  " *Giornale del Genio Militare* (with Plates), 1863 to 1867.
  " *Giornale d'Artiglieria*, 1861 to 1868.
  Reports by General Torre to the Italian Minister-at-War on the Conscription, from 1863 to 1866.
By the NETHERLANDS Government—
  60 Plates (Artillery Equipment.)
By the RUSSIAN Government—
  Two numbers of the *Military Journal*, 1869.
  Ditto *Engineering* ditto.
By the Government of SAXONY—
  17 Plates (Military Improvements.)

By the SWISS GOVERNMENT—
The Field Exercise for the Troops of the Swiss Confederation; also *Report of the Federal Military Department on its Administration in* 1868.

By J. TRAVERS SMITH, Esq.—
17 volumes of *Bulletins of the Campaigns*, 1793 to 1810; of which 2 volumes were retained for the Library of the Institution, and 15 volumes, being duplicates, were presented to The Prince Consort's Library at Aldershot.

By THE ROYAL INSTITUTION OF GREAT BRITAIN—
73 volumes of *Navy Lists*, of which 34 volumes were kept for the Library; the remainder, being duplicates, were presented to the Royal Naval College at Portsmouth.

ESTHER LADY RADSTOCK has presented a valuable collection of rare and interesting works (205 volumes), chiefly on Naval matters, from the Library of her late husband, Admiral Lord Radstock.

The exchange of Journals with Foreign Governments, and with various Scientific Societies in this country, has been continued: and a similar arrangement has been made with the Archæological Institute, and with the Editors of the *Revue Militaire Française*, and of *Professional Papers on Indian Engineering.*

The Library now contains 14,660 volumes.

TOPOGRAPHICAL DEPARTMENT.

10. His Royal Highness the Field Marshal Commanding-in-Chief has presented a set of Photographs, taken by the Royal Engineers in Abyssinia.

The Secretary of State for War has presented the Route Survey of Abyssinia; Lithographic Plates of the Manufacturing Departments of the Royal Arsenal at Woolwich; Photographs of Guns, Casemates, Shields, Targets, &c.

The Belgian Government has presented five Sheets of the Topographical Map of Belgium.

Lieutenant F. Bonnevie, Norwegian Royal Guard, Corresponding Member of the Institution, has presented the first Sheet of a Military Map of Norway; and Lithographic Views of the Cathedral of Drontheim.

MUSEUM.

11. The additions to the Library and Museum will be found duly recorded in the Proceedings of the Annual General Meeting, and in the Appendix to Vol. XIII. of the Journal. To the following, however, the Council desire to draw the attention of the Members, viz.:—

1stly. A silver-mounted Shield, Sword, Spear, and curious War Implement from Abyssinia, presented, through the India Office, by Lieutenant-General Lord Napier of Magdala, G.C.B., G.C.S.I., &c.

2ndly. Trophies from Bhootan, consisting of Match-locks, Bows, Arrows and Quivers, Swords, Shields, &c., taken at the re-capture of Dewangiri by the 55th Regiment, under the command of Colonel Hume, C.B.; presented by Colonel Hume, C.B., and Major Hume, 55th Regiment.

The Uniform and Accoutrements of a Private of the Horse, and the Foot Artillery, 1st Dragoon Guards, and 10th Hussars, also the New Uniform and Accoutrements of a Soldier of the Line, have been deposited by the War Office in the Museum.

The Secretary of State for War has sanctioned an arrangement by which specimens of the improved Arms, Clothing, Accoutrements, and Military Stores, adopted into the Service from time to time, will be placed in the Museum.

In the Naval Department a series of Half-block Models (with diagrams of sections) illustrating the progress of Naval Construction, from the time of the screw line-of-battle ship to the present period, is in course of formation. These Models are being constructed by permission of the Lords Commissioners of the Admiralty in H.M. Dockyards at the expense of the Institution. Models of H.M. Ships "Howe," "Duncan," "Ariadne," "Warrior," and "Hercules," have been already received.

The thanks of the Council have been tendered to the Secretaries of State for War and for India, to the Lords Commissioners of the Admiralty, and to the various Donors, for their respective contributions to the Institution.

VICE-PATRONS.

12. The Council have the pleasure of announcing that His Royal Highness Prince Arthur, K.G., and His Serene Highness the Prince of Teck, G.C.B., have become Vice-Patrons of the Institution.

They have also had the pleasure of electing Sir George Rose Sartorius, K.C.B., Admiral of the Fleet, and Field-Marshals Sir Alexander Woodford, G.C.B., G.C.M.G., and Sir William M. Gomm, G.C.B., Vice-Patrons.

It is with regret that they record the deaths of the following distinguished officers, viz.:—Field-Marshal Viscount Gough, K.P., G.C.B., G.C.S.I., &c., and Sir William Bowles, K.C.B., Admiral of the Fleet.

HONORARY MEMBERS.

13. Several Officers of Foreign Services were elected Honorary Members of the Institution during their stay in this country.

CORRESPONDING MEMBERS OF COUNCIL.

14. On the 1st January, 1870, there were 306 Corresponding Members of Council, as compared with 279 at the same period last year. This increase is very gratifying, and the Council take the opportunity of the circulation of this Report to thank their Corresponding Members for their services.

CONCLUSION.

In conclusion, the Council congratulate the Members on the state of the finances and on the general efficiency of the Institution.

Sir HARRY VERNEY, Bart., M.P.—

I have very great pleasure in moving that the Report which has just been read, "be adopted and printed for circulation amongst the Members." The last words read to us by our Secretary were: "In conclusion, the Council congratulate the Members on the state of the finances, and on the general efficiency of the Institution." Sir, I think that the efficiency of the Institution has been proved by the admirable papers which have been read to us during the past year, by the discussions that have followed them, and by the effect those discussions have had upon the general organisation and improvement of the Army. A wise Minister listens to what passes in this room, because he is aware that the Officers who take part in the discussions here are anxious for the welfare of the Army and the Navy, and are uncontrolled and uninfluenced by constituents or by any considerations but those which apply to the Services; therefore, I think that a Minister has a very great advantage in being able to know what passes here. In the discussions which here take place, Officers interchange opinions as to what they consider may be beneficial for the Services, and thus, quite freely and openly, subjects are discussed by those who have no other object than the good of the Military Services of the country. A wise Minister, therefore, reaps the greatest advantage from hearing what takes place in this room; and I must congratulate the Military Service that our Right Honorable Chairman has taken advantage of the discussions that have been held here by Officers of the highest authority, and has inaugurated that which, for my part, I believe will be the greatest boon and advantage to the Army; I mean "Short Service." Of course this is not the place or time to discuss the benefit or disadvantage of different proposals; but still I think I may be permittted to congratulate this meeting, that the discussions that have taken place here, have evidently told upon the mind of my Right Honorable friend, and that he has brought forward a motion and a proposal which, I believe, will be beneficial to the Service, and will certainly unite the army with civilians, with the whole body of the nation, in a way in which, up to this time, they have not been united. I must congratulate the country on there being an Institution like this; because, as we have sailors and soldiers in all parts of the world, we are able to collect scientific and political information of all kinds, and from this place as a centre, it can be made useful not only to the Services, but to the country at large. The great advantage which this Institution has been to the country, has been shown over and over again. Do not let us, however, suppose that we have nothing to learn from foreign countries. We have a great deal to learn, not only as regards the Army and the Navy, but as regards the interests of the country at large. I am sure that those *best acquainted* with foreign countries will confess, that we have a great deal to learn *from* foreign countries. I recollect once being with an army of 40,000 men, every man of whom knew everything that a soldier ought to know. From every company, three men were told off for cooking, three for purchasing meat, three for buying vegetables, three to collect accounts, others to look over the accounts, and others for different sorts of objects. Why, surely an army constituted in that way must be the best army in the world. Such was the case with Napoleon's army at Boulogne, that army which won Eylau and Austerlitz. That was the most universally working army that Napoleon ever had, and they were the bravest and the best soldiers he ever had. Now, Sir, Marshal Bugeaud confessed, "The English Infantry are the best Infantry in the world; happily there are few of them"; but the few we have, ought to be rendered as efficient as possible, both Officers and men. This would make the profession more and more interesting; it would lead the feelings of the nation with our Army, and I say that every exertion ought to be made,—and I believe that the Right Honorable gentleman is now making them,—to render our small Army—very small indeed compared with those of Continental nations, small compared with the territories it has to defend, and the enormous wealth and the most important interests it has to protect,—as efficient as possible. I have much pleasure in moving the Resolution that has been placed in my hands.

Admiral Sir **Edward Belcher**, K.C.B.—

I have great pleasure in rising to second the motion, "That the Report be adopted and printed." As one of the founders of this Institution, I may say that I see the advance that it has made, with very great pleasure. When it was first commenced, it was a mere museum; the different Officers in our Services were invited to contribute from the collections made by them in all parts of the world. At length it was found it would be more useful to convert it into what it is now, an Institution, where discussions on subjects connected with both Services, can be carried on. I am happy to see that year by year, the Institution increases, and I have hopes that it will ultimately be of very great importance to the Government.

The names of the eight Members retiring from the Council by rotation, were read as follows:—

- Vice-Admiral R. **Collinson**, C.B.
- Colonel Sir R. A. **Shafto Adair**, Bart., F.R.S.
- Captain Sir **Sibbald Scott**, Bart.
- Lieut.-Col. H. C. **Fletcher**, Scots Fusilier Guards.
- Captain W. D. **Malton**
- General Sir **William. J. Codrington**, G.C.B.
- Admiral Sir **Henry J. Codrington**, K.C.B.
- Captain M. S. **Nolloth**, R.N.

Admiral **Inglefield**, C.B., F.R.S.—

I beg to propose the Second Resolution, and in doing so I wish to express my agreement with what fell from Sir Harry Verney with respect to the advantage it is to a Minister holding the position you, Sir, occupy, to receive the information which comes from different members of the Services; but as Ministers do receive these advantages from us, so we hope that they will give us some advantage in return. The great object of this Institution now is, to obtain a permanent position in some Government building. I feel that this is an occasion when we can, Sir, draw your attention to this matter perhaps better than at any other time. With reference to the success of this Institution, there is only one point in the Report that appears to me which can be deemed hardly satisfactory, viz., that we have fallen off some twenty in our numbers. Now, I think if members will do what has been done so successfully in the Royal Geographical Society, that is to speak of the merits and advantages of the Institution among their brother Officers, we shall, probably next year, have to record a larger number of members than we can this year—only 165. In the Geographical Society a great number of men have been got together entirely by the different members pointing out to their acquaintances and friends the advantages of joining. Very few Officers in the Services would fail to join this Institution, if it was well known, that in this place Lectures are given upon scientific subjects,—that there is a large Museum and Library,—and that here they may meet with their brother Officers and discuss interesting topics. The Resolution that has been put into my hand is—"That the thanks of this Meeting be given to the Members of the Council who retire by rotation, and that the following Members be elected to fill the vacancies:—

Vice-Admiral R. Collinson, C.B.	For Re-election.	Col. A. H. Lane-Fox, late Grenadier Guards.
Lieut.-Col. H. C. Fletcher, Scots Fusilier Guards.		Major-General Sir Andrew S. Waugh, Kt., F.R.S.
General Sir William J. Codrington, G.C.B.		Rear-Admiral J. W. Tarleton, C.B.
Captain W. Horton, R.N.		Col. H. Hume, C.B.
Col. H. A. Ouvry, C.B.		Rear-Admiral A. P. Ryder.

The last two are as a reserve in case of vacancies occurring.

Colonel Gossett, R.E.—

It would be presumptuous in me to add anything to the excellent remarks tha have been made, and I therefore simply second the Resolution.

The Resolution was then put from the Chair, and carried unanimously.

General Boileau, F.R.S.—

The Resolution which has been put into my hands conveys a vote of thanks to the Auditors. This Resolution, which I shall read presently, must not be considered as the offering of a mere tribute of empty praise or as mere verbiage, to those who have performed the duties of Auditors: for, although the general abstract of accounts appears small, it really involves a considerable amount of labour and responsibility. Each of the lines necessitates a reference to a great number of items of detail, and it is the duty of the Auditors not only to scrutinise these accounts, but to examine the details, and to see that they correspond with the sums entered in the abstract. This duty is a very arduous one, as I can state from experience, and it is also a very reponsible one. I think, therefore, our best thanks are due to those who have undertaken this duty. The Resolution is—

"That the thanks of the meeting be given to the Auditors for their valuable services, and that the following gentlemen be elected for the ensuing year:—

Captain J. E. A. Dolby, for Re-election.
H. F. Downes, Esq.
Thomas Smith, Esq."

Admiral Sir Frederick Nicolson, Bart., C.B.—

I have much pleasure in seconding the motion. As a member of the Finance Committee I am well aware of the numerous details into which the Auditors must examine in order to do their duty towards the Institution in a thorough manner. I am happy to say, so far as I know, there have been no mistakes of any importance in those accounts. I cordially second the vote of thanks to the Auditors.

The Resolution was then put from the Chair, and carried unanimously.

The Chairman then announced that the business of the Meeting was concluded.

The Chair having been taken by General Lindsay,

General STANHOPE said—

I have to ask for your kind thanks to the Right Honorable the Secretary of State for War, for the very able way in which he has fulfilled the duties of Chairman here this day. He, I hope, feels thoroughly the great use of this Institution, and I feel perfectly confident, that in the present Secretary of State for War we shall have a firm and constant friend, and one who will assist this Institution in every way in his power. I propose, Gentlemen,

"That the thanks of this Meeting be given to the Right Honorable the Secretary of State for War for his kindness in attending on this occasion."

Admiral Lord FREDERICK KERR—

I have very great pleasure in seconding the motion.

The motion was carried with acclamation.

The Right Hon. EDWARD CARDWELL—

Gentlemen, I assure you that it has given me the greatest pleasure to accept your invitation, and to have had the honor of presiding on this occasion. I feel extremely the importance of this Institution, and am very much impressed with the feeling which has been expressed in some speeches, namely, that the Government derives the greatest advantage from the labours of those gentlemen who contribute to the literature of this Institution. We live in a time when pure science, and applied science, and historical investigation, contribute probably more than at any former period, to the real progress of the Military Profession. It is, therefore, peculiarly useful at the present time, that the most able and intellectual members of the two professions should have a home where they can meet in friendly intercourse and honorable rivalry, for the purpose of discussing questions relating to their professions. Their doing so, ventilates those questions. Many of the most interesting subjects which afterwards occupy practical attention, find the first germs of their existence in the Lectures of this Institution; and according to what we read in the statements of modern philosophers, viz., that germs when they are weakly, perish soon, and no more is heard of them, but that when they are hardy and robust, they flourish into the light: so those germs become the origin of future practical measures, to be adopted by the Government and by the State. Therefore it is that I feel not only the general advantage of the Institution, but its peculiar advantage at a period like the present. It is your excellent practice not to have lengthened speeches, and I should wish to be the last of all men to violate that principle. Your scope is action and not talking, and I think I should not do well if I failed to observe your excellent rule. I would just make two remarks as a civilian. First, when I read all that science is doing, and all that the study of history is doing, the first thing that I rejoice in as a civilian, is to see that great as are the improvements in the arts of attack, if possible still greater are those which are made in the arts of defence. I trust that that honorable rivalry will be maintained, and I for one shall always rejoice when I think that the science of defence is still gaining on the science of attack. The next remark I wish to make is this: a great philosopher has said that all things go round in cycles, and I have been extremely struck when I have noticed how very much the progress of the most advanced science, seems to bring us back upon some of the footprints of history. In the Middle Ages, in order to protect themselves in war, men plated their bodies with iron; we do not do this in our days, but we are all occupied in considering how best to plate our vessels with iron. Going back to a still earlier period, we find when Julius Cæsar invaded England, earthworks and entrenched camps were designed by the military science of that day; we now find the most advanced science of modern days is carrying us back to the times of Cæsar. Nay, even in the smallest matters, we sometimes find this curious historical parallel. The first time I went to Pimlico to see the manufactory there, I found men engaged in a very ingenious manufacture of shakos from the bark of the cork tree, and I was amused to remember that Virgil describes Eneas as visiting a people whose headgear was made of cork:

"Tegmina quêis capitum raptus de subere cortex."

I assure you that I have had the greatest pleasure in presiding on this occasion. I do not know that I ought to condole with you on the prospect of being disturbed in your premises, because I sincerely hope that, if in consequence of any improvements that may take place in this neighbourhood, you are disturbed, the result may be that I may have the pleasure of seeing you in a more commodious place, and one in which your abundant treasures may be properly exhibited.

STATEMENT OF CHANGES AMONG THE MEMBERS SINCE 1ST JANUARY, 1869.

			Life.	Annual.	Total.
Number of Members, 31st December, 1868 ..			891	2,921	3,812
" " joined during 1869 ..			22	143	165
			913	3,064	3,977
Changed from Annual to Life			+6	−6	
			919	3,058	3,977
	Life.	Annual.			
Deduct—Deaths during 1869 ..	19	79			
Withdrawals ..		59			
Struck off		28			
			19	166	185
Number of Members on 1st January, 1870 ..			909	2,893	3,792

TABULAR ANALYSIS OF THE STATE OF THE INSTITUTION,
To 31st of December, 1869.

Year. 1st Jan. to 31st Dec.	Annual Subs. received.	En-trance Fees.	Income (from all sources).*	Life Subs. received.	Amount of Stock.	Invested in the purchase of Books, &c.	No. of Vols. in Library.	No. of Members on the 31st Dec.	Number of Visitors
	£	£	£	£	£	£			
1831	654	..	654	1,194	..	..	..	1,437	..
1832	1,146	..	1,146	973	..	..	..	2,699	..
1833	1,405	..	1,450	692	..	..	..	3,341	..
1834	1,500	..	1,549	583	1,100	..	..	3,748	13,376
1835	1,480	..	1,574	366	2,430	40	..	4,155	8,537
1836	1,570	..	1,682	330	3,747	45	..	4,069	8,521
1837	1,549	..	1,747	222	4,747	180	..	4,164	10,907
1838	1,462	..	1,634	230	5,500	246	..	4,175	15,788
1839	1,399	..	1,565	168	5,500	292	..	4,186	16,248
1840	1,363	..	1,525	198	5,500	446	5,500	4,257	17.120
1841	1,450	..	1,643	186	6,000	243	5,850	4,243	19,421
1842	1,373	..	1,565	144	6,400	373	6,450	4,127	21,552
1843	1,299	..	1,494	140	6,700	237	7,000	4,078	27,056
1844	1,274	..	1,408	112	3,000	298	7,850	3,968	22,767
1845	1,313	..	1,466	228	1,500	127	8,100	3,988	21,627
1846	1,298	..	1,456	138	1,500	74	8,410	4,031	32,885
1847	1,314	74	1,502	132	1,700	37	..	4,017	38,699
1848	1,175	57	1,375	48	1,700	85	9,641	3,947	37,140
1849	1,176	72	1,375	84	1,150	58	..	3,970	33,333
1850	1,141	106	1,294	198	600	36	..	3,998	33,773
1851	1,136	131	1,292	66	666	34	10,150	3,188	52,173
1852	1,134	133	1,281	114	200	43	10,300	3,078	20,609
1853	1,243	319	1,684	264	528	41	10,420	3,251	25,952
1854	1,200	138	1,368	126	612	95	10,587	3,171	22,661
1855	1,159	107	1,289	120	653	55	10,780	3,131	14,778
1856	1,216	197	1,519	156	761	47	10,832	3,204	16,184
1857	1,258	176	1,937	78	1,038	40	10,960	3,168	12,755
1858	1,318	221	2,102	105	438	31	11,062	3,246	25.747
1859	1,526	195	2,277	512	946	70	11,320	3,344	28,739
1860	1,961	298	3,577	397	2,178	114	11,517	3,518	28,011
1861	2,122	305	2,899	266	2,846	99	11,812	3,689	23,296
1862	2,296	242	3,127	239	3,178	109	12,026	3,797	27,215
1863	2,379	218	3,100	405	3,583	143	12,296	3,847	18,150
1864	2,425	215	3,253	222	4,516	116	12,700	3,902	17,276
1865	2,435	154	3,467	235	4,804	137	13,000	3,895	18,253
1866	2,435	157	3,488	299	5,486	150	13,337	3,891	17,067
1867	2,431	141	3,467	208	5,732	140	13,800	3,823	17,211
1868	2,446	184	3,534	297	6,396	119	14,100	3,812	16,417
1869	2,368	165	3,485	238	6,653	232	14,660	3,792	15,947

* Including Annual Subscriptions, Entrance Fees, Donations, Legacies, and Interest on Funded Property also the Grant from Government, commencing in 1857.

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BOOKS PRESENTED.

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The Author.

ABYSSINIA. Report on the Survey. Pamph. Folio.
The Secretary of State for War.

ADMIRALTY. Addenda to "The Queen's Regulations and Instructions for Paymasters" of 1861. Compiled from Circulars and Orders issued since August 6th, 1861.

Catalogue of Charts, Plans, Views, and Sailing Directions. 8vo. London, 1869.

ALMANAC. The Nautical, for 1873. 8vo. London, 1869.
The Lords Commissioners of the Admiralty.

ARMY Lists, Monthly, for 1816 and 1856. 16mo. 2 vols.
Royal Institution.

ASTRONOMICAL, Magnetical, and Meteorological Observations made at the Royal Observatory Greenwich, in the Year, 1867. 4to. London, 1869.
The Lords Commissioners of the Admiralty.

AUSTRIAN Army, Administration of the. Pamph. Folio. Vienna, 1869. Translated by Lieut. Wickham, R.A.
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AUSTRIA. Mittheilungen der Ingenieur. Nos. 9, 10, 11, for 1868.

Ditto ditto Nos. 1 to 8, for 1869.

AUSTRIA. Mittheilungen der Artillerie. Nos. 5, 6, 7, 8, for 1868.

Ditto ditto Nos. 1, 2, 3, 4, 5, 7, for 1869.

8vo. Vienna, 1868–69.
The Austrian Government.

AUSTRIA. Österreichs Kämpfe im Jahre 1866. Vols. 4 and 5. 8vo. Vienna, 1869.
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The Author.

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Brialmont, A., Colonel. La Fortification Polygonale et les Nouvelles Fortifications d'Anvers, Réponse aux Critiques. Pamph. 8vo. Paris, 1869. *Anonymously.*

Bulletins of the Campaigns 1793 to 1801, and 1803 to 1810. 17 vols. 12mo. *J. Travers Smith, Esq.*

Charles XV, Roi de Suéde et de Norvége. Idées et Réflexions sur les movements de la Tactique Moderne, avec deux planches intercalées dans le texte. 8vo. Paris, 1868. *Anonymously.*

Chesney, C. C., Lieut.-Colonel, R.E. The Tactical Use of Fortresses. Pamph. 8vo. London, 1868. *The Author.*

Chronometers, Rates of, on Trial for purchase by the Board of Admiralty, at the Royal Observatory, Greenwich. Pamph. 4to. 1869. *The Astronomer Royal.*

Claxton, Colonel. Les Mitrailleuses, leur rôle dans les opérations Militaire. (Artillerie a bras et Infanterie Mécanique.) 8vo. Liège, 1869. *Captain O'Hea.*

Coast or Fishery Barometer Manual. Board of Trade, 1869. Compiled by Robert H. Scott, M.A., Director of the Meteorological Office. Pamph. 8vo. London, 1869. *W. F. Higgins, Esq.*

Cust, General the Honble. Sir Edward, D.C.L. Lives of the Warriors of the 17th Century. Vol. 3. Part 1. 8vo. London, 1869. *The Author.*

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Eddy, C. W., Esq., M.A. Suggestions on Colonial means of Defence from Naval Attack. Pamph. 8vo. 1865. *The Author.*

Elcho, Lord. Letters and Speeches on Army Organization and Reserves. Pamph. 8vo. London, 1869. *Anonymously.*

Engineering, Indian, Professional Papers on. Edited by Lieut.-Colonel J. G. Medley, R.E., Principal Thomason College, Roorkee, India. Vols. 1 to 5. 8vo. 1864–68. *The Editor.*

Ewart, C.B., Lieut.-Colonel R.E. Report on the proper Principle of Drainage for Oxford, Eton, Windsor, and Abingdon. Pamph. 8vo. 1868. *The Author.*

Extracts from the Reports of the Ordnance Select Committee. Vol. 6. Parts 2, 3, 4. Vol 7. Parts 1, 2, and 3. *The Secretary of State for War.*

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The Author.

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The Author.

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Secretary of State for War.

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Superintendent Meteorological Office.

Meteorology of the North Atlantic, Report on. By Captain Henry Toynbee, F.R.A.S. Pamph. 8vo. 1869.
The Author.

Meteorological Reports to the Government of Bengal, for 1867–68 and 1868–69. Pamph. Folio. Calcutta, 1868–69.
The Meteorological Committee of Calcutta.

Meteorological Society. List of Members. 1869. Pamph. 8vo.
The Society

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The Board.

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Colonel Ouvry, C.B.

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The Author.

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8. Arrêté concernant la Coiffure de l'Armée Suisse, 1869.

9. Tableau des Ecoles Militaire Fédérales, 1869. 4to. Berne.

10. Etat de l'Etat-Major Fédéral Suisse, 1869. 8vo. Berne.

11. Répartition de l'Armée Suisse, 1869. 8vo. Berne.
The Swiss Government.

Sylvester, J. J., LL.D., F.R.S. Ad-

dress to the Mathematical and Physical Section of the British Association. Pamph. 8vo. Exeter, 1860.
The Author.

THAMES TUNNEL, Explanation of the Works of the. Pamph. 4to. London, 1862. *Anonymously.*

TIDE TABLES for the British and Irish Ports for 1869. 8vo. 1868.
The Lords Commissioners of the Admiralty.

TRENCH, F., Captain, 20th Hussars. A New System of Military Transport, as applicable to Modern Warfare. Pamph. 8vo. London, 1868.
The Author.

UNITED STATES. Report of the Secretary of the Navy, 1862–63–64–65 and 1867. 8vo. Washington.
Vice-Adm. Sir Alexander Milne, K.C.B.

VAUX, W. S. W., Esq., on English and Foreign Waterloo Medals. Pamph. 8vo. London, 1869.
Captain A. C. Tupper.

WAR OFFICE. INDEX to the Several Articles in the Periodical Publications received in the War Office, from 1st January to 31st October, 1869.
The Secretary of State for War.

WAR, The Rudiments of; a Series of Orders and Military Regulations. 12mo. London, 1777.
Captain Lendy.

WEBBER, C. E., Captain R.E. The Duties of a Royal Engineer Officer in time of Peace; with Suggestions for the Organization of the Staff of an Army. Pamph. 8vo. London, 1869.
The Author.

WHITWORTH, Sir Joseph, Bart., F.R.S.

1. On the Penetration of Armour Plates, with long Shells of large capacity fired obliquely.
2. Rifled Artillery. The Whitworth Polygonal and the Woolwich Studded Projectiles.
3. The Proof of Guns.
4. The proper form of Projectile for Penetration through Water. Pamph. 4to. Manchester, 1869.

The Author.

JOURNALS AND TRANSACTIONS.

INSTITUTIONS.

ASSOCIATION, BRITISH. Report of the 38th Meeting, held at Norwich, in August, 1868. 8vo. London, 1869.
The Association.

ASSOCIATION, EAST INDIA. Journal. Vol. III, Nos. 1 and 2. 8vo. London, 1869.
The Association.

CIVIL ENGINEERS, Proceedings of. Vol. XXVII, for 1867–68; Vol. XXVIII for 1868–69.
The Institution.

ENGINEER ESTABLISHMENT, ROYAL. Elementary Acoustics, and its Application to the Construction of Buildings. Lectures by W. Fletcher Barrett, Esq. Folio. Chatham, 1869.

On Water Wheels, Turbines, &c.; and on the Steam Engine. Lectures by W. Cawthorne Unwin, Esq. Folio. Chatham, 1869.

PROFESSIONAL PAPERS of the Corps of Royal Engineers. Vol. XVII. New Series. 8vo. Woolwich, 1869.
The Establishment.

MECHANICAL ENGINEERS, Birmingham. Proceedings, 30th April, 1868; Leeds Meetings, 28th and 29th July, 1868. Parts 1, 2, and 3. 1868.

Proceedings, 5th November, 1868.
Ditto 28th January, 1869.
Ditto 29th April, 1869.
Ditto 3rd and 4th August, 1869. Newcastle Meeting. Parts 1 and 2.
The Institution.

NAVAL ARCHITECTS. Transactions of. Vols. IX and X. 4to. London, 1868–69.
The Institution.

ROYAL, of Great Britain, Proceedings of. Vol. V. Nos. 49 and 50.

List of Members, 1869.

Additions to the Library, July, 1868, to July, 1869.
The Institution.

ROYAL ARTILLERY, Proceedings of. Vol. VI. Nos. 7 to 10. 8vo. Woolwich, 1869.
The Institution.

ROYAL NATIONAL LIFE BOAT, Journal of. Vol. VII. Nos. 71 and 72.

Annual Reports for 1868–69. 8vo. 1868-69.
The Institution.

SOCIETIES.

ANTIQUARIES, Proceedings of. Vol. IV. Nos. 3 to 6. 8vo. London, 1868-69.
Archæologia. Vol. XLII. 4to. London, 1869.
The Society.

ARTS, Journal of. Vol. XVII for 1869. 8vo. *The Society.*

MANCHESTER, Literary and Philosophical.
Memoirs, Vol. XIII. 8vo. 1856; vols. I and III, Third Series. 8vo. 1862-68.
Proceedings, Vols. II, V, VI, VII. 8vo. 1862-68.
The Society.

ROYAL, Proceedings of. Vol. XVII, Nos. 106 to 113; Vol. XVIII, Nos. 114 and 115.

REPORT of the Meteorological Committee of the Royal Society for the year ending 31st December, 1868. 8vo. London, 1869.
The Society.

ROYAL, of Edinburgh, Proceedings of. Session for 1867-68. Vol. VI. No. 74.
Transactions, 1867-68. Part 1. Vol. XXV. 4to.
The Society.

ROYAL AGRICULTURAL, of England, Journal of. Vol. V, Nos. 9 and 10. 8vo.
The Society.

ROYAL ASIATIC Journal of. Vol. III, Part 2, New Series. 1868.
Vol. IV. Part 1, New Series. 1869.
The Society.

ROYAL GEOGRAPHICAL, Proceedings of. Vol. XIII. Nos. 1 to 5. 8vo. 1869.
Journal of. Vol. XXXVIII. 1868. 8vo.
The Society.

ZOOLOGICAL SOCIETY of London, Proceedings for the Year 1868. Part III.
Proceedings for 1869. Part I.
Transactions. Vol. VI. Part VIII. 4to.
The Society.

BOOKS PURCHASED.

ABRICHTUNGS Reglement fur die Kaiserlich Königlichen Inktruppen (Austrian Evolutions of Infantry). 12mo. Wien, 1868.

ADYE, John, Colonel R.A. The Defence of Cawnpore by General C. A. Windham in November, 1857. 8vo. London, 1858.

ALEXANDER, J. E., Captain. Sketches in Portugal during the Civil War of 1834. 8vo. London, 1835.

ALISON, Colonel Sir Archibald, Bart. On Army Organization. 8vo. London, 1869.

ALMANACH DE GOTHA for 1870. 32mo. Gotha, 1870.

ANNUAIRE MILITAIRE DE L'EMPIRE FRANÇAIS. 1869.

ANNUAIRE DES DEUX MONDES. Histoire Générale des divers Etats, 1866-1867. 8vo. Paris, 1868.

ANTIQUARIES, Society of. Archæologia. Vols. 3 to 10, 13 and 15. 4to. London, 1786 to 1806.

AUSTRIA. Army List for 1869. 8vo. Vienna, 1869.

BADEAU, Adam, Colonel United States Army. Military History of Ulysses S. Grant, 1861 to 1865. Vol. I. 8vo. New York, 1868.

BACOT, Surgeon-Major. The Bahamas; a Sketch. 8vo. London, 1869.

BAKER, Valentine, Colonel 10th Hussars. Army Reform. Pamph. 8vo. London, 1869.

BATEMAN, J. F., and Révy, J. J. Description of a Cast Iron Tube for a Channel Railway between England and France. Pamph. 8vo. London, 1869.

BELL, Evans, Major. The Oxus and the Indus. 8vo. London, 1869.

BERMUDA. A Colony, a Fortress, and a Prison; or, Eighteen Months in the Somers' Islands. By a Field Officer. 8vo. London, 1857.

BLACKIE, W. G. Supplement to the "Imperial Gazetteer." 4to. London, 1868.

BLUE BOOK. Hungerford Bridge and Wellington Street Viaduct. First Report. Folio. 1869.

BOUTELL, C. Arms and Armour in Antiquity and the Middle Ages, translated from the French of M. P. Lacombe. 8vo. London, 1869.

BOX, Thomas. A Treatise on Heat as applied to the useful Arts. 8vo. London, 1868.

BOYNTON, Charles B., D.D. The History of the Navy during the Rebellion. Illustrated. Vol. II. 8vo. New York, 1869.

Brande, W. T. A Dictionary of Science, Literature, and Art. New Edition, edited by W. T. Brande, late of Her Majesty's Mint, and the Rev. George W. Cox, M.A. 3 vols. 8vo. London, 1867.

Brandt, Dr. Heinrich von. Aus dem leben des Generals der Infanterie, 1808-1833. 2 vols. 8vo. Berlin, 1868–69.

Brialmont, A., Colonel. Traité de Fortification Polygonale. 2 vols. 8vo. Bruxelles, 1869, with Atlas of Plates.

Browne, W. A. The Money, Weights, and Measures of all Nations, with the British Equivalents. 12mo. London, 1869.

Bulletins and other State Intelligence for the Year 1862. Compiled from the "London Gazette." By T. L. Behan, Superintendent. 2 vols. London, 1862.

Burgoyne, Sir John Fox, Bart., G.C.B. Our Defensive Forces. Pamph. 8vo. London, 1869.

Campbell, Major-General Sir Neil. Napoleon at Fontainebleau and Elba; with a Memoir of General Sir Neil Campbell by his Nephew, Archibald Neil Campbell Maclachlan, M.A.. 8vo. London, 1869.

Cannon, John. History of Grant's Campaign for the Capture of Richmond, 1864–65. 8vo. London, 1869.

Carpenter, W. B. Manual of Physiology, including Physiological Anatomy. 8vo. London, 1865.

Principles of Human Physiology. 8vo. London, 1869.

Charles XV, Roi de Suède et de Norvége. Considérations sur l'Infanterie. Pamph. 8vo. Stockholm, 1868.

Chartres, Robert d'Orléans, Duc de. Une visite à quelques Champs de Bataille de la Vallée du Rhin. 8vo. London, 1869.

Charrin, Capitaine. De l'emploi d'un Abri Improvisé; le Havre sac pare balles. 8vo. Paris, 1869.

Chauvenet, W. Spherical and Practical Astronomy. 2 vols. London, 1868.

Chesney, C. C., Lieut.-Colonel R.E. Chinese Gordon. A Memoir, reprinted from "Fraser's Magazine." 8vo. London, 1869.

Chesney, Francis Rawdon, General. Narrative of the Euphrates Expedition, carried on by order of the British Government in 1835, '36, and '37 8vo. London, 1868.

Chesney, George, Accountant-Genera to the Government of India. India Polity: a view of the system of Ad ministration in India. 8vo. Londo 1868.

Clode, Charles M. The Military Forc of the Crown; their Administratio and Government. 2 vols. 8vo. Lo don, 1869.

Colonial Office List for 1869. W. Robinson and A. N. Birch. 8 1869.

Cotton, General Sir Sydney, K.C. The Central Asian Question. Pam 8vo. Manchester, 1869.

Counsels to Authors. Plans of P lishing, and Specimens of Types. London, 1863.

D'Aumale, Le Duc. Histoire Princes de Condé. 2 vols. Paris, 1863.

Davidson, Edward, Captain, R.E. Railways of India, their rise, prog and construction. From the Rec of the India Office. 8vo. Lon 1868.

Dana, J. D. A System of Mineral 8vo. London, 1868.

Daru, P. Histoire de la Républiqu Venise. 2nd edition. 8 vols. Paris, 1821.

Delarclause Savin. Vie de Sey par Varnhagen Von Ense. Tr de l'Allemand. 8vo. Paris,

Demmin, Auguste. Guide des teurs d'Armes et Armures Ancie 8vo. Paris, 1869.

Dircks, Henry. Life of the Ma of Worcester; with his Centu Inventions, 1663. 8vo. London,

Dundonald, Earl of, and Bourne, Fox. The Life of Thomas, Cochrane, Earl of Dundonald, pleting "The Autobiography Seaman." 2 vols. 8vo. L 1869.

East India Company, Charters g to the, from 1601; also Treatie Grants made with, or obtained the Princes and Powers in Indi 1756 to 1772. 4to.

Engel, André. Dictionnaire Tec Polyglotte des Termes de la English, French, Russian. St. burgh, 1863–1868. Part 1. to 5. A to Re.

Dictionnaire Militaire Tec French, German, English, R St. Petersburgh, 1863–68. Nos A to Cl.

ERICHSEN, J. E. The Science and Art of Surgery. 2 vols. 8vo. London, 1869.

EWALD, A. C. The Last Century of Universal History, from 1767 to 1867. 8vo. London, 1868.

FIX, Théodore, Capitaine d'Etat Major. La Télégraphie Militaire. 8vo. Paris, 1869.

FOREIGN OFFICE LIST FOR 1869. By Edward Hertslet, Esq. 8vo. 1869.

FRANCE. Conférences Régimentaires. 32mo. Paris, 1869.

1. L'Etat Militaire de la France et des Puissances Etrangères.
2. Armement Nouveau; Modification de la Tactique.
3. Les Chemins de Fer et la Télégraphie Militaire.
4. La Tactique séparée de la Cavalerie.
5. La Campagne d'Allemagne en 1866 (with two Maps).
6. L'Infanterie Prussienne en 1866.
7. La Cavalerie en Allemagne en 1866.
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9. La Géographie de l'Allemagne (with Map).
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12. La Fortification Passagère dans les Combats.
13. La Garde Nationale Mobile.
14. Service de Santé en Campagne.
15. Quelques récents Travaux sur la Tactique.

FRANCE. Règlement sur les manœuvres de l'Infanterie. 12mo. Paris, 1869.

FRANKLAND, W. A., Captain R.E. A Sapper's Manual, for the use of Engineer Volunteer Corps. Part I. 16mo. London, 1869.

FREY, L. Das Officiers-pferd. 18mo. Leipzig, 1869.

FULTON, Robert. Torpedo War and Submarine Explosions. Plates. 4to. New York, 1810.

GRIVEL, R., Capitaine de Vaisseau. De la Guerre Maritime avant et depuis les nouvelles inventions. 8vo. Paris, 1869.

HALL, Charles Henry, Esq. The Life of Andrew Hofer; with an account of the transactions in the Tyrol, in 1809. 8vo. London, 1820.

HALLAM, Henry. Supplement to "Europe during the Middle Ages." 8vo. London, 1848.

HAKLUYT SOCIETY'S PUBLICATIONS. The Fifth Letter of Hernan Cortes to the Emperor Charles V, containing an account of his Expedition to Honduras. 8vo. London, 1868.

First Part of the Royal Commentaries of The Yncas, by the Ynca Garcilasso de la Vega. Vol. 1 (containing books 1, 2, 3, and 4). 8vo. London, 1869.

The Three Voyages of Vasco da Gama, and his Viceroyalty; from the Lendas da India of Gaspar Correa. 8vo. London, 1869.

HAMLEY, E. B., Colonel. The Operations of War. 2nd edition. 4to. London, 1869.

HARRISON, Conyers, Esq. The Life and Reign of Queen Anne. 8vo. Cambridge, 1744.

HAUPT, Hermann, A.M., C.E. Military Bridges. 8vo. New York, 1864.

HOME, John, Esq. The History of the Rebellion in the Year 1745. 4to. London, 1802.

HOZIER, H. M., Captain. The British Expedition to Abyssinia. 8vo. London, 1869.

HUTCHINSON, Lucy. Life of Colonel Hutchinson, with an account of the Siege of Lathom House. 5th edition. 8vo. London, 1846.

INFANTRY, Manœuvres for a Battalion of; the Command of Small Detachments, and the Manual Exercise. By a German Officer. 12mo. London, 1776.

JAMES, Colonel Thomas, Royal Artillery. History of the Straits of Gibraltar. 2 vols. 4to. London, 1771.

JESSE, J. Henneage. Life and Reign of George III. 3 vols. 8vo. London, 1867.

KESSEL General. Die Ausbildung des Preussischen Infanterie Bataillons im praktischen Dienst. 8vo. Berlin, 1869.

KIRKALDY, David. Experiments on Wrought Iron and Steel. 8vo. London, 1866.

LARPENT, Sir George, Bart. The Private Journal of F. S. Larpent, Esq., Judge Advocate-General during the Peninsula War, from 1812 to its close. 3 vols. 8vo. London, 1853.

LEGOYT, M. A. et Vogt M. G. La Suisse. Territoire, Population, Agriculture, Industrie, Commerce, Histoire, Institutions. 8vo. Paris, 1866.

LOWNDES, W. T. The Bibliographer's Manual of English Literature. 4 vols. 8vo. London, 1864.

Lucknow, The Defence of. A Diary of the Siege of the Residency in 1857. By a Staff Officer. 8vo. London, 1858.

Lyell, Sir Charles. Principles of Geology. 10th edition. 2 vols. 8vo. London, 1867.

McCulloch, J. R., Commercial Dictionary. Edited by H. G. Reid. 8vo. London, 1869.

McMurdo, General, C.B. Rifle Volunteers, their Arms, Equipment, and Administration. Pamphlet. 8vo. London, 1869.

Markham, Clements R. The Abyssian Expedition. 8vo. London, 1869.

Martens, G. F. de. Recueil Général de Traités et autres actes relatifs aux rapports de droit international. Continuation par Charles Samwer. Vol. 17. Part 2. 8vo. Gottingen, 1869.

MacDougall, P. L., Colonel. The Army and its Reserves. Pamph. 8vo. London, 1869.

Military Work by Military Labour, with Remarks on Mr. Hanbury-Tracy's motion before Parliament. By an Officer of Royal Engineers. Pamph. 8vo. London, 1869.

Moncrieff, C. C. Scott, Lieut. R.E. Irrigation in Southern Europe. Report of a Tour of Inspection in France, Spain, and Italy, in 1867–68. 8vo. London, 1868.

Montmorency, R. H. de, Colonel. Exercise of the Lance, compiled from the Polish system, with an account of the Banners and Orders of Chivalry. 4to. London, 1820.

Napier, W. C. E., General. Outpost Duty, by General Jarry; with Treatises on Military Reconnaissance and Roadmaking. 8vo. London, 1869.

Napoleon I, Commentaires de. 6 vols. 4to. Paris, 1867.

Napoleon I, Correspondance de. Vols. 26, 27, 28, 29. 8vo. Paris, 1868–70.

Navy. The Active List of Officers. From the Original of the late Rev. W. Harvey. By Captain W. Arthur and James Griffin. 8vo. Portsea, 1869.

Ney, Marshal, Memoirs of. Published by his Family. 2nd edition. 2 vols. 8vo. London, 1834.

Nichols, Thomas. A Hand-Book for Readers at the British Museum. 8vo. London, 1866.

Notes and Queries. General Index to Second and Third Series. 2 vols. 4to. London, 1862–68.

Odiardi, E. Des Balles Explosibles et Incendiares. 8vo. Paris, 1869.

Paris Exhibition, 1867. Rapport de la haute Commission Militaire. 8vo. Paris, 1869.

Paris, Vice-Admiral. L'Art Naval à l'Exposition Universelle de Paris en 1867. Vols. 3 and 4. 8vo. With Atlas Folio. Paris, 1868–69.

Pellew, Pownoll, Commander R.N. Fleet Manœuvring. 4to. London, 1868.

Petermann, Dr. A. Mittheilungen aus Justus Perthes Geographischer anstalt über wichtige neue Erforschungen auf dem Gesammtgebiete der Geographie. No. 9. Gotha, 1866.

Phillips, Colonel J. C. Abolition of the Bonus System in the Indian Army. Pamph. 8vo. London, 1869.

Price, Lake. Manual of Photographic Manipulation. 8vo. London, 1868.

Prussia. Army List for 1869. 8vo. Berlin, 1869.

Quain, R. Elements of Anatomy. Edited by W. Sharpey. 2 vols. 8vo. London, 1867.

Rankine, W. J. Macquorn. The Steam Engine and other Prime Movers. 8vo. London, 1869.

Records of the 18th Hussars. By Captain H. E. Malet. 8vo. London, 1869.

Records of the Light Horse Volunteers of London and Westminster, with Muster Rolls from 1779 to 1829. 8vo. London, 1843.

Reed E. J., C.B. Our Iron Clad Ships. London, 1869.

Register, The Annual, for 1868. 8vo. London, 1869.

Roscoe, H. E. Spectrum Analysis. Six Lectures, delivered in 1868 before the Society of Apothecaries of London. 8vo. London, 1869.

Royal Society of London. Catalogue of Scientific Papers (1800–63). Vol. 2. 4to. London, 1868.

Scott, John. A Visit to Paris in 1814–15, by way of Brussels and Waterloo. 2 vols. 8vo. London, 1816.

Seckendorff, G. Graf von. Meine Erlebnisse mit dem Englischen Expeditions Corps in Abyssinien, 1867–68. 8vo. Potsdam, 1869.

Sleeman, W. H., Colonel. Rambles and Recollections of an Indian Official. 2 vols. 8vo. London, 1844.

Journey Through Oude in 1849–50, with Correspondence relative to its Annexation. 2 vols. 8vo. London, 1858.

Smiles, Samuel. Lives of the Engineers, their Principal Works, and a History of Inland Communication in Britain. 3 vols. 8vo. London, 1862.

Smith, W. Dictionary of the Bible. 3 vols. 8vo. London, 1863.

Strombeck, K. Freiherrn von. Kriegs Tagebücher, 1864–66. 8vo. Leipzig, 1869.

Stumm, F., Lieutenant, Hannover Hussar Regiment. Meine Erlebnisse bei der Englischen Expedition in Abyssinien, 1868. 8vo. Frankfort, 1868.

Styffe, Knut. The Elasticity, Extensibility, and Tensile Strength of Iron and Steel. 8vo. London, 1869.

Tackels, C. J., Capitaine. Armes de Guerre; les Armes se chargeant par la Culasse, les Mitrailleuses et leur munitions. 8vo. Leipzig, 1869.

Conférences sur le Tir, et projets divers relatifs au nouvel Armement, 8vo. Paris, 1869.

Thiers, M. A. Histoire du Consulat et de l'Empire, faisant suite a l'histoire de la Révolution Française. Vol. 21. 8vo. Paris, 1869.

Thompson, George, Lieutenant-Colonel of Engineers and A.D.C. to President Lopez. The War in Paraguay. 8vo. London, 1869.

Times, Index to the, October 1st, 1867, to December 31st, 1869. 9 vols. 4to.

Trench, F., Captain. The Russo-Indian Question, with a Map of Central Asia. 8vo. London, 1869.

Tuckey, J. K., Captain, R.N. Expedition to the River Zaire or Congo, in South Africa, in 1816. 4to. London, 1818.

Tyndall, John, F.R.S. Sound: a Course of Eight Lectures delivered at the Royal Institution. 8vo. London, 1869.

Upton, Emory, General, U.S. Army. A new system of Infantry Tactics, double and single rank. 12mo. New York, 1868.

Vancouver, George, Captain. Voyage to the North Pacific and Round the World, 1790-95. 3 vols. 4to. London, 1798.

Venn, Thomas, Captain. Military and Marine Discipline, Tactics, Architecture and Gunnery. Folio. London, 1672.

War Office List and Administrative Directory for the British Army, 1869. 8vo. London, 1869.

Watts, Henry. Dictionary of Chemistry. 5 vols. 8vo. London, 1868.

Wellington, The Words of. Compiled by Edith Walford. 18mo. London, 1869.

Wilson, Andrew. The "Ever Victorious Army," the Taiping Rebellion, and the Chinese Campaign, under Colonel C. G. Gordon, C.B., R.E. 8vo. London, 1868.

Wolff, Joseph. Mission to Bokhara, in 1843–45. 8vo. London, 1846.

Wolseley, G. J., Colonel. The Soldier's Pocket-Book for Field Service. 12mo. London, 1869.

Wyatt, W. J. Captain. On the Formation of Armies; and translation of "Responsibility in War," by the Archduke Albrecht of Austria. Pamph. 8vo. London, 1869.

PERIODICALS PURCHASED.

Allen's Indian Mail.
Annales du Conservatoire.
Annual Register.
Army Lists—Hart's.
    Monthly.
Artizan.
Athenæum.
Broad Arrow.
Engineer.
Engineering.
Gazettes—Army and Navy.
    Naval and Military.
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    Volunteer Service.
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Journals—Des Armes Spéciales.
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    Woolwich.
Kelly's Post Office Directory.
Le Spectateur Militaire.
Magazines—London, Edinburgh, and Dublin Philosophical.
    Mechanics'.
    Colburn's United Service.
    Nautical, and Naval Chronicle.
Navy List—Quarterly.
Notes and Queries.
Quarterly Journal of Science.
Reviews—Edinburgh.
    Quarterly.
    Westminster.
Revue des deux Mondes.
Statesman's Year-Book.
The Lancet.
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Presented.

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Ceuta and the adjacent Country, Chart of, from the French Surveys, 1855. Positions of Batteries, from Spanish Map of November, 1859.
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India, Photograph of Relief Map of (from the Original Model). By R. Montgomery Martin.
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Charts (26 in number), and Pilot Charts for the Atlantic Ocean.
The Lords Commissioners of the Admiralty.

H.M.S. "Northumberland" Four Plans to illustrate a Lecture given in 1867, on the Launch of.
Sir J. C. D. Hay, Bart., M.P.

Pei Ho, copy of the Order of Anchoring off the. Printed on Board the "Imperieuse," Admiral Sir J. Hope, August, 1860. *J. Barrow, Esq., F.R.S.*

Abyssinia. Route Survey of the Line of March of the Army under Lord Napier of Magdala. 1868. 5 Sheets. Ordnance Survey Office, Southampton, 1869.
The Secretary of State for War.

Norway, Military Map of, 1869. 1 Sheet.

Drontheim, Lithographic Views of the Cathedral of.
Lieut. F. Bonnevie, Norwegian Royal Guard.

Historical Chronological Plan of the Movements and Principal Actions of the Army in the Peninsula during the War in Spain against Bonaparte. 1818. In Spanish.
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Lithographic Plates of the Manufacturing Departments of the Royal Arsenal, Woolwich. 47 in number.
Secretary of State for War.

Drawing of a proposed Pneuma-Hydraulic Propeller, by H. M. Lefroy. Fremantle, West Australia, 1869.
Anonymously.

Channel Railway between England and France, Plan. By J. F. Bateman, Esq., F.R.S. *The Author.*

Holland. Plan of Canal and Railway near Amsterdam.
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MAPS PURCHASED.

Russia in Europe, Map of. By J. Bartholomew, F.R.G.S.

Turkey in Europe, ditto ditto.

Greece, The Ionian Islands, and the Archipelago, with the neighbouring portions of Turkey, Map of. By W. Hughes, F.R.G.S.

Germany, Kiepert's Map of New, 1867. Nine coloured sheets. Berlin, 1867.

Marocco, Theatre of War in, Ceuta and Gibraltar. One sheet.

La Confédération du Nord et les Etats du Sud, par le Capitaine Schenck. Carte Militaire. Paris, 1868.

France et Etats Limitrophes, sous le Gouvernement de la Restauration, en 1830, et en 1868.

Ces trois Cartes font connaitre au public la position de la France vis-à-vis de l'Europe a trois époques distinctes; sous la Restauration, le Gouvernement de Juillet, et le Second Empire. One sheet. Paris.

Bermudas or Somers' Islands, Map of; the Bar and Harbour of St. George, the Narrows, and Murray Anchorage, and a Panoramic View of the Islands. By A. G. Findlay, Esq., F.R.G.S. London, 1864.

Turkestan, with the adjoining portions of British and Russian Territories. 1868. Compiled in the Office of the Surveyor-General of India. Four sheets.

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Bows (2) and Arrow (1) from the Philippine Islands. The larger bow and the arrow are those used by the I-TÁ, Negritos, a small black race inhabiting the hills, generally thought to be the Aborigines; and not under Spanish rule.

Cris of the Chief of the last Sooloo Pirate Fleet that went to the Philippine Islands.
Edward Jackson, Esq.

Tomahawks, one of wood, the other with an iron head, taken by the 50th Regiment in New Zealand.
Lieut.-Col. A. C. Locke, 50th Regt.

Shields (4), Matchlocks (2), Bows (3), Quivers with Arrows (4), Swords (6), Scabbards (3), Bullet Mould (1), Water Bottle (1), Ink Bottle (1), Do., with Penholder; taken by the 55th Regiment at the recapture of Dewangiri, in Bhootan.
Col. Hume, C.B., and Major Hume, 55th Regt.

Breech-loading Gun, by Krupp.
A. Longsden, Esq.

ARMS

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Australian Shields (2).
Do. Club.
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Model of the Barracks at Newcastle, Jamaica.
Lady Gomm.

MODELS.

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Sectional Model of Parsons 8″-Gun, ¼ size.
Do., do., of Major Pallisser's converted 64-pr. M.L. Rifled Gun, with Shot.
Model of 7-pr. Gun, as used in Abyssinia, with double and common Shell.

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Presented.

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Major J. T. N. O'Brien, Major-General of Police, Mauritius.

58 Specimens illustrative of Eastern Ethnology, &c.

Major-General Edward Pole.

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Lieut. J. B. Sparks, Bengal Staff Corps.

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These Models illustrate a form of building advocated by the late Captain Henderson.

Mrs. Henderson.

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Mr. George Reed, R.N.

Portrait of Vice-Admiral Charles Watson, Rear-Admiral of the Blue, 1754.

John Barrow, Esq., F.R.S.

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OF THE

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[APRIL, 1870.]

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